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# TROPICAL DISEASES BULLETIN

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BUREAU OF HYGIENE AND TROPICAL DISEASES.

# TROPICAL DISEASES BULLETIN.

Vol. 42.] 1945. [No. 8.

## VERTEBRATES AND ARTHROPODS EXAMINED IN INVESTIGATIONS OF THE EPIDEMIOLOGY OF YELLOW FEVER.

By J. F. Corson, O.B.E., M.D., D.P.H., D.T.M. & H.
*Acting Assistant Director, Bureau of Hygiene and Tropical Diseases.*

Some animals, particularly monkeys and opossums in the South American jungle, seem to play an important part in the epidemiology of yellow fever. As the virus can multiply only within cells, and as it circulates only for a few days in the blood, owing to the rapid development of specific antibodies, it is thought that there can be no animal reservoir of the disease in the sense in which the term is usually employed, *i.e.* a persistent infection of varying degrees of severity from inapparent to acute infections with little risk of its dying out from lack of susceptible animal hosts. In yellow fever, infection is so quickly followed by immunity that the term animal reservoir seems to be unsuitable, though the difference appears to be one of degree rather than a qualitative one. In some mosquitoes, however, the virus may persist for some weeks and probably for the lifetime of the insect, and it has been suggested that the true reservoir may be said to be the insect vector.

In man and monkeys the presence of antibodies to the virus of yellow fever, whether found in nature or developed after experimental inoculation of the virus by the syringe or by mosquito bite, is regarded as indicating that the virus has multiplied in the cells of the body and has circulated in the blood, even though no illness may have been caused by it. This view is based upon a considerable amount of observation and experiment; it applies to both the ordinary (viscerotropic) and the neurotropic viruses and means that the animal was susceptible to infection and became immune. It forms the basis of surveys to discover the extent of areas where yellow fever exists or has existed.

Some individuals of other Orders of vertebrates, however, have been found to possess naturally-occurring antibodies to yellow fever, in places and circumstances where previous infection with yellow fever has been impossible as well as in areas where such infection could not be excluded, though apparently very unlikely. These antibodies have usually been called non-specific; the animals in which they occur are not necessarily immune to infection with yellow fever since the inoculation of a small dose of the virus stimulates the production of further antibodies which are regarded as specific and as indicating that the virus has multiplied in the body cells and has circulated in the blood. Special care and precautions are therefore necessary for the correct interpretation of the presence of naturally-occurring antibodies to yellow fever in animals other than monkeys. Some animals are resistant to infection and these may or may not have so-called non-specific antibodies in their blood.

It has been shown that yellow fever virus can persist for some time in the bodies of various invertebrates, including other arthropods than mosquitoes but,

so far as is known at present, the latter are the only vectors in nature. As the virus can pass through the skin and mucous membranes, various ways of mechanical infection are possible; it has occurred in several laboratory workers.

The following extract from "The Rockefeller Foundation; a Review for 1944," by Raymond B. FOSDICK is of great interest:—

"In Villavicencio alone, in an endemic yellow fever region, more than 2,000 animals have been trapped, ranging all the way from mice to wildcats and monkeys, and from birds to snakes and other reptiles. Each was tested to see whether it had acquired immunity to yellow fever, or, if not, whether it responded to inoculation with the virus. Two species only showed positive results—the monkey and the opossum. That is, antibodies against yellow fever were found in their bloodstreams, evidence that at some time past they had been infected with the virus.

"In June, 1944, the laboratory at Ilhéus trapped a sick monkey, a marmoset. In its bloodstream were discovered not antibodies but the active virus of yellow fever. The animal was seriously ill and soon died, and exhaustive laboratory tests showed conclusively that it had died of yellow fever.

"This episode is historically interesting, because it is the first time in any country that a wild animal has been picked up in its natural habitat suffering from yellow fever. It lends support to the thesis that yellow fever is primarily a disease of jungle animals transmitted by jungle mosquitoes."

In the accompanying Table I of animals tested for susceptibility to yellow fever virus, infection is indicated by a plus sign, and negative results of experiments by a zero sign; a note of interrogation indicates a doubtful result. Susceptibility has been shown by illness (with death or recovery), pathological lesions, the presence of circulating virus, or the presence of specific antibodies. Infection has been produced by the bites of naturally or experimentally infected mosquitoes, by injection of emulsions of ground-up bodies of mosquitoes, and by injection of infected blood or tissue by various routes, including the intracerebral route. The presence or absence of naturally-occurring antibodies in the blood is also recorded in this table but, except in monkeys, these antibodies should not be regarded as specific without consulting the original papers. A short list of invertebrates in which the virus can persist for various periods is given in Table II.

The presence of yellow fever virus has been demonstrated in wild-caught mosquitoes and in mosquitoes allowed to feed, under laboratory conditions, on infective animals. Two methods have been used, *viz.* (1) to allow the mosquitoes to feed on a clean susceptible animal, in which cases a positive infection is due to virus transmitted by bite; and (2) to inject into susceptible animals an emulsion of the triturated bodies of a pool of mosquitoes, in which case a positive result indicates only the presence of virus in the bodies of mosquitoes. The significance of the retention of virus in the bodies of mosquitoes which have failed to transmit the infection by biting is doubtful. Of the wild-caught mosquitoes (not given a further opportunity of becoming infected after capture) the only species proved infective by bite are *Aëdes leucocelaenus*, and *Haemagogus capricorni* [*janthinomys*; *equinus* ?]*, but the presence of virus has been proved, by injection of triturated mosquito bodies, in wild-caught *Aëdes aegypti* and *Aëdes simpsoni* and in a pool of 88 Sabethine mosquitoes of various genera. Except in the case of the fatal infection of LAZEAR in a hospital ward where mosquitoes were being fed on yellow fever patients, and where the origin of the mosquito which bit him was unknown, no wild-caught *Aëdes aegypti* appears to have been directly proved infective by biting; the circumstantial evidence, however, is conclusive. Details of the findings in mosquitoes infected under laboratory conditions are given in Table III.

* See footnote to Table III.

TABLE I*—VERTEBRATES TESTED FOR SUSCEPTIBILITY TO YELLOW FEVER VIRUS.

| Species | Common Name | Country | Viscerotropic | | | Neurotropic | | P.A. in Nature | References *Tropical Diseases Bulletin* Year and page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mosq. | | Inj. Bld. or Tiss. | | | | |
| | | | B | I | | IC | EC | | |
| CLASS: MAMMALIA | | | | | | | | | |
| ORDER: PRIMATES | | | | | | | | | |
| FAMILY PONGIDAE | | | | | | | | | |
| *Gorilla gorilla* ... ... ... ... | Gorilla ... ... ... | Africa ... | | | | | | 0 | 1939, 632; 1942, 65 |
| *Pan satyrus* [*Anthropopithecus troglodites*] | Chimpanzee ... ... | ,, ... | | | + | | | + | 1928, 537, 538; 1932, 576; 1936, 339; 1939, 632, 634; 1941,432 |
| *Pan satyrus schweinfurthi* ... ... | Chimpanzee ... ... | ,, ... | | | | | | 0 | 1936, 339; 1939, 632; 1942, 65 |
| FAMILY CERCOPITHECIDAE | | | | | | | | | |
| *Cercopithecus aethiops centralis* [*C. griseoviridis*] | African grivet monkey... | ,, ... | + | | + | | + | + | 1928, 851; 1930, 488; 1938, 124; 1940, 93; 1943, 771 |
| *C. tantalus* ... ... ... ... | Tantalus monkey ... | ,, ... | + | | + | + | | | 1930, 875; 1931, 719; 1933, 354; 1936, 624 |
| *C. diana diana* ... ... ... ... | Diana monkey ... ... | ,, ... | | | | | | + | 1938, 124 |
| *C. nigroviridis* [*Allenopithecus nigroviridis*] | Dark green monkey ... | ,, ... | | | | | | 0 | 1936, 339 |
| *C. aethiops sabaeus* [*C. callitrichus* or *Lasiopyga callitrichus*] | Green monkey ... ... | ,, ... | | | + | + | | 0 | 1934 (579); 1935, 550; 1936, 339 |
| *C. patas* [*Erythrocebus patas*] ... ... | Patas or Hussar monkey | ,, ... | + | | + | + | | 0 | 1930, 875; 1931, 719; 1936, 624; 1938, 124 |
| *C. cephus* ... ... ... ... ... | Moustached guenon ... | ,, ... | | | | | | 0 | 1936, 339 |
| *C. neglectus* ... ... ... ... | Schlegel's guenon ... | ,, ... | | | | | | 0 | 1936, 339 |
| *C. aethiops cynosurus* ... ... ... | Malbrouck's guenon ... | ,, ... | | | | | | 0 | 1936, 339; 1939, 632 |
| *C. mona* ... ... ... ... | Mona monkey ... ... | ,, ... | 0 | | 0 | + | | | 1930, 875; 1931, 719; 1936, 624 |
| *C. mona lowei* ... ... ... ... | Lowe's mona monkey ... | ,, ... | | | | | | 0 | 1936, 339 |
| *C. ascanius schmidti* ... ... ... | Schmidt's white - nosed monkey | ,, ... | | | | | | + | 1942, 455 |
| *C.* sp. ... ... ... ... ... | | ,, (Gold Coast) | | | | | | 0 | 1938, 124 |

* NOTES.—Mosq.=mosquito; B.=transmission by bite; I.=transmission by injection of crushed bodies; Inj., Bld. or Tiss.=injection of blood or tissues of infected vertebrate; I.C.=intracerebral injection of virus; E.C.=extracerebral injection of virus; P.A.=protective antibodies. The references are to abstracts in the *Tropical Diseases Bulletin*. See also HINDLE's table in this *Bulletin*, 1933, v. 30, 285.

| Species | Common Name | Country | Viscerotropic | | | Neuro-tropic | | P.A. in Nature | References *Tropical Diseases Bulletin* Year and page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mosq. | | Inj. Bld. or Tiss. | | | | |
| | | | B | I | | IC | EC | | |
| *Cercopithecus* s.p. ... ... ... | | Africa (Liberia) | | | | | | + | 1938, 124 |
| *Cercocebus torquatus* ... ... ... | White crowned mangabey | ,, ... | + | | + | | | | 1930, 875; 1931, 719 |
| *Cercocebus galeritus agilis* ... ... | Agile mangabey... ... | ,, ... | | | | | | 0 | 1936, 339; 1939, 634 |
| *Cobobus polykomos* [*C. vellerosus*] ... | King colobus monkey ... | ,, ... | | | | | | + | 1938, 124; 1939, 634; 1940, 90 |
| *C. badius* [*Procolobus badius badius*] ... | Bay colobus monkey ... | ,, ... | | | | | | + | 1938, 124 |
| *C. badius waldroni* ... ... ... | | ,, ... | | | | | | + | 1938, 124 |
| *C. badius*, subsp. nov. ... ... ... | | ,, ... | | | | | | + | 1936, 339 |
| *C. badius*... ... ... ... ... | | ,,(Ashanti) | | | | | | + | 1936, 334 |
| *Papio jubilaeus* ... ... ... ... | Baboon ... ... ... | ,, ... | | | | + | | 0 | 1939, 634; 1940, 94 |
| *P. anubis* ... ... ... ... | Olive baboon ... ... | ,, ... | | | | | | 0 | 1939, 634 |
| *P. papio* [*Cynocephalus sphinx*] ... | Guinea baboon ... | ,, ... | | | 0 | | | | 1930, 488 |
| *P. cynocephalus* [*C. babouin*] ... ... | Yellow baboon ... ... | ,, ... | | | + | + | + | + | 1928, 851; 1936, 339; 1938, 497 |
| *P. hamadryas* [*C. hamadryas*] ... ... | Sacred or Arabian baboon | ,, ... | | | + | | | | 1928, 851; 1929, 307; 1938, 497 |
| *P. sp.* ... ... ... ... ... | | ,, (Congo) | | | | | | + | 1936, 339 |
| *Mandrillus sphinx* [*Cynocephalus mormon*] | Mandrill ... ... ... | ,, ... | | | | | | 0 | 1936, 339 |
| *Macaca mulatta* [*Macacus rhesus*] ... | *Rhesus*, bandar or Bengal monkey | Asia ... | | | + | + | + | | 1928, 537, 538, 852; 1929, 305, 1,000; 1935, 590; 1940, 93 |
| *M. radiata* [*Macacus sinicus*] ... ... | Bonnet monkey ... | ,, ... | | | + | | | | 1928, 527, 538, 851 |
| *M. irus* [*Macacus cynomolgus*] ... | Crab-eating macaque or Kra monkey | ,, ... | | | + | + | + | | 1928, 852; 1929, 305; 1930, 869; 1933, 354; 1935, 590; 1936, 624 |
| *M. nemestrina* ... ... ... ... | Pig-tailed macaque ... | ,, ... | + | | 0 | | | | 1930, 869 |
| *M. fuscata* [*Macacus speciosus*] ... | Japanese monkey ... | ,, ... | | | + | | | | 1929, 305 |
| *M. sylvana* [*Macacus inuus*] ... ... | Barbary ape ... ... | Africa ... | | | + | | | | 1930, 875; 1936, 339 |
| FAMILY CEBIDAE | | | | | | | | | |
| *Cebus cirrifer* ... ... ... ... | White checked capuchin | S. America | | | + | | | | 1941, 67 |
| *C. albifrons* ... ... ... ... | White-fronted capuchin | ,, | | | + | | | 0 | 1932 (579) |
| *C. capucina* [*C. hypoleucus*] ... ... | White-throated capuchin | ,, | | | + | | | 0 | 1932 (579) |
| *C. frontatus* ... ... ... ... | Capuchin or "prego" monkey | ,, | + | | | + | | | 1933, 718; 1941, 67 |
| *C. fatuellus* [*C. macrocephalus*] ... | Brown capuchin ... | ,, | + | | + | | | + | 1929, 1,000; 1930, 488, 1944, 475 |
| *C. flavus*... ... ... ... ... | Bearded capuchin ... | ,, | + | | + | | | | 1930, 488 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *C. apella* ... ... ... ... ... | Weeper capuchin ... | S. America | | | | | + | 1937, 344 |
| *C. xanthosternos* [*C. variegatus*] ... | Smooth-headed capuchin | ,, | + | | + | | | 1930, 488; 1931, 727 |
| *C.* sp. ... ... ... ... ... | | ,, | | | | | + | 1944, 475 |
| *Pseudocebus azarae* ... ... ... | Azara's capuchin monkey | ,, | | | + | | | 1930, 488, 495 |
| *Callicebus ornatus* ... ... ... | Titi monkey ... ... | ,, | | | | | + | 1937, 344 |
| *Callicebus moloch* ... ... ... | Molock titi monkey ... | ,, | | | + | | | 1931, 727 |
| *Callicebus leucocephala* ... ... ... | Marmoset ? ... ... | ,, | | | + | | | 1944, 747 |
| *Cacajao rubicundus* ... ... ... | Red uakari monkey ... | ,, | + | | + | | | 1931, 727 |
| *Aotus trivirgatus* ... ... ... | Night-ape or owl-faced monkey | ,, | + | | | | | 1931, 727 |
| *Alouatta fusca* ... ... ... ... | Red howling monkey ... | ,, | | | + | | | 1941, 66 |
| *Alouatta seniculus* ... ... ... | Red howling monkey ... | ,, | + | | | | | 1931, 727 |
| *Pithecia monacha* ... ... ... | Saki monkey ... ... | ,, | | | | + | | 1933, 727 |
| *Ateles ater* ... ... ... ... | Black - faced spider monkey | ,, | + | | + | | | 1930, 874; 1931, 727 |
| *A. paniscus* ... ... ... ... | Red-faced spider monkey | ,, | | | | + | | 1933, 354 |
| *A. variegatus* ... ... ... ... | Variegated spider monkey | ,, | | | | + | | 1933, 718 |
| *A. barthleti* ... ... ... ... | | ,, | | | | | + | 1944, 475 |
| *Saimiri sciurea* ... ... ... ... | Squirrel monkey ... | ,, | + | | + | + | + | 1930, 86; 488, 874; 1933, 354 718; 1937, 344 |
| *S. sciurea caquetensis* ... ... ... | Squirrel monkey ... | ,, | + | | + | + | | 1944, 749 |
| *Lagothrix humboldti* [*L. lagotricha*] ... | Woolly monkey ... | ,, | | | + | | + | 1930, 874; 1944, 475 |
| FAMILY HAPALIDAE | | | | | | | | |
| *Hapale jacchus* [*Callithrix jacchus*; *Callithrix albicollis*] | Marmoset ... ... | ,, | + | | + | + | | 1930, 86; 1931, 292; 1933, 718; 1944, 747 |
| *H. penicillata* ... ... ... ... | Black-eared marmoset ... | ,, | | | | | 0 | 1937, 344 |
| *Callithrix* sp. ... ... ... ... | | ,, | | | | + | | 1933, 718 |
| *Leontocebus rosalia* ... ... ... | Lion marmoset ... ... | ,, | | | + | | | 1944, 747 |
| *L. ursulus* [*Mystax ursulus*] ... ... | Black tamarin ... ... | ,, | + | | + | + | | 1931, 292; 1933, 718 |
| FAMILY GALAGIDAE | | | | | | | | |
| *Galago senegalensis senegalensis* ... | " Bush baby " ... ... | Africa ... | | | | | 0 | 1938, 124 |
| ORDER: LIPOTYPHLA | | | | | | | | |
| FAMILY ERINACEIDAE | | | | | | | | |
| *Erinaceus europaeus* ... ... ... | European hedgehog ... | Europe ... | | | + | + | | 1934, 501, 841 |
| *E. pruneri* [*E. albiventris*] ... ... | Nigerian hedgehog ... | Africa ... | | | | + 0 | | 1936, 342 |
| *E. pruneri* ... ... ... ... | Sudan hedgehog ... | ,, ... | | | + | | | 1935, 291; 1936, 342 |
| FAMILY SORICIDAE | | | | | | | | |
| *Crocidura manni* ... ... ... | Shrew ... ... ... | ,, ... | | | | 0 0 | | 1936, 342 |

| Species | Common Name | Country | Viscerotropic | | | Neurotropic | | P.A. in Nature | References *Tropical Diseases Bulletin* Year and page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mosq. | | Inj. Bld. or Tiss. | IC | EC | | |
| | | | B | I | | | | | |
| ORDER: CHIROPTERA | | | | | | | | | |
| FAMILY PTEROPODIDAE | | | | | | | | | |
| *Epomophorus* sp. ... ... ... | Fruit-eating bat ... | Africa ... | | | | | | 0 | 1936, 339 |
| *E. wahlbergi haldemani* ... ... ... | Fruit-eating bat ... | ,, ... | | | | + | | | *C.R. Soc. Biol*, 1936, v. 123, 1007 |
| *Desmodus rotundus* ... ... ... | Vampire bat ... ... | S. America | 0 | + | | | | | 1933, 6 |
| *Molossus obscurus* ... ... ... | House bat ... ... | ,, | 0 | + | | | | | 1933, 6 |
| ORDER: CARNIVORA | | | | | | | | | |
| FAMILY PROCYONIDAE | | | | | | | | | |
| *Nasua narica* ... ... ... ... | White-nosed coati or coati mundi | ,, | | | 0 | + | | | 1939, 652 |
| *Nasua* sp. ... ... ... ... | | ,, | | | | | | 0 | 1944, 475 |
| *Potos flavus* ... ... ... ... | Kinkajou ... ... | ,, | | | + | | | 0 | 1941, 434 |
| FAMILY CANIDAE | | | | | | | | | |
| *Cerdocyon thous azarae* ... ... ... | Crab-eating fox or rough fox | ,, | | | 0 | | | | 1939, 652 |
| *Vulpes vulpes* ... ... ... ... | Common fox ... ... | Europe ... | | | | + | + | | 1938, 497 |
| *Canis familiaris* ... ... ... | Dog ... ... ... | ,, ... | | | + | | | + | 1931, 724; 1939, 652; 1940, 93, 550; 1942, 65 |
| *Uricyon* [*Urocyon* ?] ... ... ... | Fox ... ... ... | S. America | | | | | | 0 | 1941, 434 |
| FAMILY MUSTELIDAE | | | | | | | | | |
| *Putorius foetidus* [*P. furo* ?] ... ... | Ferret ... ... ... | Europe ... | | | | + | | 0 | 1932 (579); 1934, 498; 1938, 497; 1939, 652 |
| *Lutra* sp. ... ... ... ... | Otter ... ... ... | | | | | | | 0 | 1941, 434 |
| *Tayra barbara* ... ... ... ... | Tayra ... ... ... | S. America | | | 0 | + | | | 1939, 652 |
| FAMILY VIVERRIDAE | | | | | | | | | |
| *Civettictus civetta* (?) ... ... ... | African civet cat ... | Africa ... | | | | | | 0 | 1944, 122 |
| FAMILY FELIDAE | | | | | | | | | |
| *Felis catus* ... ... ... ... | Domestic cat ... ... | | | | + | + | | | 1931, 724; 1934, 498 |
| *F. tigrina* ... ... ... ... | American tiger-cat ... | S. America | | | | | | 0 | 1941, 434 |
| *Herpailurus pardinoides* ... ... | Wild cat ... ... ... | ,, | | | + | + | | | 1939, 652 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ORDER: RODENTIA | | | | | | | | |
| FAMILY SCIURIDAE | | | | | | | | |
| *Sciurus vulgaris* ... ... ... | European red squirrel ... | Europe ... | | | (visc.) | | | 1934, 498 |
| | | | | | + | | | |
| *Sciurus aestuans* ... ... ... | A tropical squirrel ... | S. America | | 0 | | | | 1939, 652 |
| *Euxerus erythropus* ... ... ... | Red-footed ground squirrel | Africa ... | | | | | 0 | 1936, 339 |
| *Citellus citellus* ... ... ... ... | Spermophile or Souslik | Europe and Asia | | 0 | + | 0 | | 1938, 497 |
| FAMILY CAVIIDAE | | | | | | | | |
| *Cavia porcellus* ... ... ... ... | Guineapig ... ... | | | + | + | | 0 | 1930, 488; 1931, 291; 1932 (579) 1934, 498; 1941, 434 |
| *C. anolaimae* ... ... ... ... | | S. America | | | | | 0 | 1941, 434 |
| *C. aperea (rufescens?)* ... ... ... | Pig-like cavy or Erxleben's guineapig | ,, | | | + | | | 1939, 652 |
| *Hydrochaerus hydrochaeris hydrochaeris* | Capybara ... ... | ,, | | + | + | | | 1939, 652 |
| FAMILY CUNICULIDAE | | | | | | | | |
| *Cuniculus paca* ... ... ... | Lapa or spotted paca ... | ,, | | + | | | 0 | 1941, 434 |
| FAMILY DASYPROCTIDAE | | | | | | | | |
| *Dasyprocta aguti* ... ... ... | Golden agouti ... ... | ,, | | 0 | + | | | 1934, 81; 1939, 652 |
| *D. variegata* ... ... ... ... | Variegated agouti ... | ,, | | + | | | 0 | 1941, 434 |
| FAMILY ERETHIZONTIDAE | | | | | | | | |
| *Coendou prehensilis* ... ... ... | Brazilian tree porcupine | ,, | | 0 | | | | 1939, 652 |
| FAMILY HYSTRICIDAE | | | | | | | | |
| *Atherurus africanus* [*Athetura africana*] | Brush-tailed porcupine... | Africa ... | | | | | 0 | 1939, 632; 1944, 122 |
| FAMILY MURIDAE | | | | | | | | |
| *Apodemus sylvaticus* ... ... ... | Long-tailed field mouse or wood mouse | | | | 0 | | | 1934, 498 |
| *Arvicanthis niloticus rufinus* ... ... | Striped mouse ... ... | ,, ... | | | | | 0 | 1936, 339 |
| [*Lemniscomys barbarus nigeriae*] ... | Striped mouse ... ... | ,, ... | | | | | 0 | 1936, 339 |
| *A. niloticus occidentalis* ... ... | Field rat ... ... | ,, ... | | | | | 0 | 1938, 125 |
| *Cricetomys gambianus* ... ... ... | Pouched rat ... ... | ,, ... | | | | | 0 | 1936, 339; 1938, 125 |
| *Mesocricetus auratus* [*Cricetus auratus*] | Golden hamster ... | Europe and Asia | | | 0 | | | 1934, 498; 1938, 497; 1939, 652 |
| *Clethriomys glareolus* [*Evotomys glareolus*] | Bank vole ... ... | ,, ,, | | | 0 | | | 1934, 498 |
| *Microtus agrestis* ... ... ... | Short-tailed vole or grass vole | ,, ,, | | | + | | | 1934, 498 |
| *Mus musculus musculus* ... ... | Mouse ... ... ... | ,, ,, | | | + | 0 | | 1933, 353; 1939, 652 |
| *M. m. gentilis* ... ... ... ... | Mouse ... ... ... | Africa (Egypt) | | | + | 0 | | 1933, 353; 1939, 652 |

| Species | Common Name | Country | Viscerotropic | | | Neurotropic | | P.A. in Nature | References *Tropical Diseases Bulletin* Year and page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mosq. | | Inj. Bld. or Tiss. | IC | EC | | |
| | | | B | I | | | | | |
| *Mus musculus azoricus* ... ... ... | Mouse ... ... ... | Azores | | | | | + | | 1933, 353; 1939, 652 |
| *Rattus coucha erythroleucus* [*Mastomys coucha erythroleucus*] | Multimammate mouse ... | Africa | | | | | | 0 | 1938, 125 |
| *Rattus rattus norvegicus* [*Epimys norvegicus*] | Brown rat ... ... | Europe ... | | | | 0 | | | 1939, 652 |
| *Nectomys squamipes* ... ... ... | ... ... ... ... | S. America | | | 0 | | | | 1939, 652 |
| *Taterona guineae* subsp. nov. ... ... | Gerbil ... ... ... | Africa ... | | | | | | 0 | 1936, 339 |
| *Zygodontomys microtinus* near *stellae* ... | Cane rat ... ... ... | S. America | | | + | + | + | 0 | 1944, 747 |
| FAMILY ECHYMYIDAE | | | | | | | | | |
| *Ctenomys* (*brasiliensis*? or *minutus*?) | "Touc-touc" ... ... | ,, | | | | + | | | 1939, 653 |
| *Thryonomys swinderianus* ... ... | Great cane rat or ground hog | Africa ... | | | | | | + | 1944, 122 |
| *Doubtful identification*— *Silvilagus*; "Red rat" (*Nectomys alfari*?); "Red mouse" (*Arizomys*?); "Dark rat" (*Nectomys grandis*?); "Black rat" (*Nectomys grandis*?); "Spiny mouse" (*Neacomys*?); "Grey mouse" (*Zygodontomys*?); "Brown mouse" (*Melanomys*?); *Proechymis chrys.* [*Proechymis cayennensis chrysaeolus*?] | | S. America | | | | | | 0 | 1941, 434 |
| ORDER: LAGOMORPHA | | | | | | | | | |
| FAMILY LEPORIDAE | | | | | | | | | |
| *Oryctolagus cuniculus* [*Lepus cuniculus*] | Rabbit ... ... ... | | | | + | 0 | | 0 | 1932 (579); 1934, 498 |
| *Sylvilagus minensis* ... ... ... | Scrub or marsh rabbit ... | ,, | | | 0 | | | | 1939, 652 |
| ORDER: ARTIODACTYLA | | | | | | | | | |
| FAMILY TAYASSUIDAE | | | | | | | | | |
| *Tayassu pecari* ... ... ... ... | Collared peccary ... | ,, | | | + | | | 0 | 1939, 652; 1941, 434; 1944, 475 |
| *Pecari tajacu* ... ... ... ... | White-lipped pecary ... | ,, | | | + | + | | 0 | |
| FAMILY BOVIDAE | | | | | | | | | |
| *Bos taurus* ... ... ... ... | Ox ... ... ... | | | | | | | + | 1936, 339; 1938, 125; 1939, 632; 1940, 550 |
| *Ovis ares* ... ... ... ... | Sheep ... ... ... | | | | | + | | + | 1936, 339; 1940, 550; 1942, 65 |
| *Capra* sp. ... ... ... ... | Goat ... ... ... | | | | | | | + | 1940, 550; 1942, 65 |
| *Cephalopus leucogaster* ... ... ... | Duiker ... ... ... | Africa ... | | | + | | | 0 | 1938, 497 |
| *C. nigrifrons* ... ... ... ... | Black-fronted duiker ... | ,, ... | | | + | | | 0 | 1938, 497 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FAMILY SUIDAE | | | | | | | | | |
| *Sus* sp. ... ... ... ... ... | Domestic pig ... ... | | | | | | | + | 1935, 290 ; 1941, 434 ; 1942, 65 |
| FAMILY CAMELIDAE | | | | | | | | | |
| *Camelus dromedarius* ... ... ... | Camel ... ... ... | Africa ... | | | | | | + | 1940, 550 |
| ORDER : PERISSODACTYLA | | | | | | | | | |
| FAMILY EQUIDAE | | | | | | | | | |
| *Equus caballus* ... ... ... ... | Horse ... ... ... | ,, ... | | | | | | + | 1928, 85 ; 1929, 307 ; 1940, 550 |
| FAMILY TAPIRIDAE | | | | | | | | | |
| *Tapirus americanus* ... ... ... | Tapir ... ... ... | S. America | | | | | | 0 | 1941, 434 |
| ORDER : XENARTHRIA | | | | | | | | | |
| FAMILY BRADYPODIDAE | | | | | | | | | |
| *Bradypus tridactylus* ... ... ... | Three-toed sloth ... | ,, | | | | 0 | | | 1939, 652 |
| FAMILY CHOLOEPODIDAE | | | | | | | | | |
| *Choloepus didactylus* ... ... ... | Two-toed sloth ... ... | ,, | | | | | | 0 | 1941, 434 |
| FAMILY DASYPODIDAE | | | | | | | | | |
| *Cabassous hispidus* ... ... ... | Armadillo ... ... | ,, | | | | | | 0 | 1944, 475 |
| *C. unicinctus* ... ... ... ... | Broad-banded armadillo | ,, | | | | + | | | 1939, 652 |
| *Dasypus novemcinctus* ... ... ... | Nine-banded armadillo... | ,, | | | | + | + | 0 | 1939, 652 ; 1944, 475 |
| *Euphractus sexcinctus* ... ... ... | Six-banded armadillo ... | ,, | | | | | 0 | | 1939, 652 |
| FAMILY MYRMECOPHAGIDAE | | | | | | | | | |
| *Tamandua tetradactyla* ... ... ... | Tamandua ant-eater ... | ,, | | | | + | | 0 | 1941, 434 |
| *Cyclopes didactyla* ... ... ... | Two-toed or little ant-eater | ,, | | | | + | | 0 | 1941, 434 |
| *Myrmecophaga jubata* ... ... ... | Great ant-eater or ant-bear | ,, | | | | + | | 0 | 1941, 434 |
| ORDER : MARSUPIALIA | | | | | | | | | |
| FAMILY DIDELPHIIDAE | | | | | | | | | |
| *Didelphis marsupialis* ... ... ... | Common opossum ... | ,, | | | | | + | + | 1941, 434 ; 1944, 475 |
| *D. marsupialis aurita* ... ... ... | Pink-tip-eared opossum | ,, | | | | + | + | | 1939, 636 |
| *D. paraguayensis* ... ... ... | White - eared common opossum | ,, | | | | 0 | 0 | + 0 | 1939, 653 ; 1941, 434 |
| *D. nudicaudatus* ... ... ... | Rat-tailed opossum ... | ,, | | | | | | + + | 1941, 434 ; 1944, 475 |
| *D. nudicaudatus columbianus* ... ... | Brown-masked opossum | ,, | | | | + | | | 1941, 434 ; 1944, 749 |
| *Metachirops opossum grisescens* ... | Grey-masked opossum ... | ,, | | | | + | | + | 1941, 434 ; 1944, 749 |
| *Caluromys* (*Mallodelphis*) *laniger* [*Caluromys laniger cicur*] | Woolly opossum ... | ,, | | | | + | | + 0 | 1941, 434 ; 1944, 475, 749 |
| *Marmosa* sp. ... ... ... ... | Long-bare-tailed murine opossum | ,, | | | | + | | + | 1935, 652 ; 1941, 434 |

| Species | Common Name | Country | Viscerotropic | | | Neurotropic | | P.A. in Nature | References *Tropical Diseases Bulletin* Year and page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mosq. | | Inj. Bld. or Tiss. | | | | |
| | | | B | I | | IC | EC | | |
| CLASS: AVES | | | | | | | | | |
| ORDER: ARDEIFORMES | | | | | | | | | |
| FAMILY ARDEIDAE | | | | | | | | | |
| *Bubulcus ibis ibis* ... ... ... | African cattle egret or buff-backed heron | Africa ... | | | | | | + | 1944, 122 |
| ORDER: PASSERIFORMES | | | | | | | | | |
| FAMILY FRINGILLIDAE | | | | | | | | | |
| *Serinus canarius* ... ... ... | Canary ... ... ... | | | | | 0 | | | 1934, 498 |
| ORDER: STRIGIFORMES | | | | | | | | | |
| FAMILY TITONIDAE | | | | | | | | | |
| *Tyto alba affinis* ... ... ... | African barn owl ... | ,, ... | | | | | | + | 1944, 122 |
| ORDER: CORACEIFORMES | | | | | | | | | |
| FAMILY ALCEDINIDAE | | | | | | | | | |
| *Halcyon senegalensis senegalensis* ... | Senegal kingfisher ... | ,, ... | | | | | | + | 1944, 122 |
| ORDER: CATHARTIFORMES | | | | | | | | | |
| FAMILY CATHARTIDAE | | | | | | | | | |
| *Cathartes* sp. ... ... ... ... | Vulture ... ... ... | S. America | | | | | | + | 1941, 434 |
| *Coragyps* sp. ... ... ... ... | Vulture ... ... ... | ,, | | | | | | + | 1941, 434 |
| ORDER: GALLIFORMES | | | | | | | | | |
| FAMILY PHASANIDAE | | | | | | | | | |
| *Gallus* sp. ... ... ... ... | Hen ... ... ... | | | | + | 0 | | 0 | 1932 (579); 1934, 498; 1936, 339; 1942, 65 |
| ORDER: COLUMBIFORMES | | | | | | | | | |
| FAMILY COLUMBIDAE | | | | | | | | | |
| *Columba* sp. ... ... ... ... | Dove ... ... ... | S. America | | | | | | 0 | 1941, 434 |
| *Leptoptila* sp. ... ... ... ... | Dove ... ... ... | ,, | | | | | | 0 | 1941, 434 |
| | Pigeon ... ... ... | ,, | | | | 0 | | | 1934, 498 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ORDER: ACCIPITRIFORMES | | | | | | | | | |
| FAMILY EGYPIIDAE | | | | | | | | | |
| *Necrosyrtes monachus monachus* ... | Common African vulture | Africa ... | | | | | | 0 | 1931, 339 |
| ORDER: STRUTHIONIFORMES | | | | | | | | | |
| FAMILY STRUTHIONIDAE | | | | | | | | | |
| *Struthio camelus* ... ... ... | Ostrich ... ... ... | ,, ... | | | | | | + | 1940, 550 |
| *Various South American birds* — | | | | | | | | | |
| *Penelopinae* (CRACIDAE) ... ... | | | | | | | | 0 | 1941, 434 |
| *Crotophagus* sp. (CUCULIDAE) ... ... | Ani ... ... ... | | | | | | | 0 | ,, ,, |
| *Aramides* sp. (ARAMIDAE) ... ... | Rail ... ... ... | | | | | | | 0 | ,, ,, |
| *Amazona* (*chrysotes*) sp. (PSITTACIDAE) | Parrot ... ... ... | | | | | | | 0 | ,, ,, |
| *Amazona Perico* (PSITTACIDAE) ... | Parakeet ... ... | | | | | | | 0 | ,, ,, |
| Species of RHAMPHASTIDAE ... ... | Toucans ... ... | | | | | | | 0 | ,, ,, |
| ,, ICTERIDAE ... ... | Caciques ... ... ... | | | | | | | 0 | ,, ,, |
| *Psophia crepitans* (PSOPHIIDAE) ... | Common trumpeter ... | | | | | | | 0 | ,, ,, |
| "Carraca" (PSOPHIIDAE) ... ... | Trumpeter ... ... | | | | | | | 0 | ,, ,, |
| "Azulejo" (PSOPHIIDAE) ... ... | Trumpeter ... ... | | | | | | | 0 | ,, ,, |
| CLASS: REPTILIA | | | | | | | | | |
| ORDER: SERPENTES | | | | | | | | | |
| FAMILY BOIDAE | | | | | | | | | |
| *Python regius* ... ... ... ... | Royal python ... ... | Africa ... | | | | | | 0 | 1944, 122 |
| | Boa constrictor ... ... | S. America | | | | | | 0 | 1941, 434 |
| | Turtle, Iguana, Lizard ... | ,, | | | | | | 0 | 1941, 434 |
| CLASS: AMPHIBIA | | | | | | | | | |
| ORDER: SALIENTIA | | | | | | | | | |
| FAMILY RANIDAE | | | | | | | | | |
| *Rana temporaria* ... ... ... | Common frog ... ... | | | | | 0 | 0 | | 1938, 497; 1939, 652 |
| *R. catesbiana* ... ... ... ... | American bullfrog ... | N. America | | | + | | | | 1932 (579) |

TABLE II.—Invertebrates in which Yellow Fever Virus (Viscerotropic) has been shown to Persist.

| Species | Common Name | Period | References *Tropical Diseases Bulletin* year and page |
|---|---|---|---|
| *Blatta germanica* ... ... ... | Cockroach ... | 15 days | 1938, 638 |
| *B. orientalis* ... ... ... | Cockroach ... | under 2 ,, | 1942, 65 |
| *Schistocerca gregaria* ... ... | Desert locust ... | under 2 ,, | 1942, 65 |
| *Locusta migratoria migratoria* ... | Locust ... | under 2 ,, | 1942, 65 |
| *Hirudo medicinalis* ... ... | Leech ... ... | 8 ,, | 1942, 65 |
| *Agriolimax agrestis* ... ... | Slug ... ... | under 2 ,, | 1942, 65 |

TABLE III.—Blood Sucking Arthropods; Transmission Experiments.*

| Species | Country | Caught in nature | | Infected in laboratory | | References *Tropical Diseases Bulletin* year and page |
|---|---|---|---|---|---|---|
| | | Bite | injn. | Bite | injn. | |
| *Aëdes aegypti* ... ... | Africa ... | | + | + | | 1932, 196; 1933, 6; 1939, 25 |
| *A. aegypti* var. *queenslandensis* ... ... ... | ,, ... | | | + | | 1942, 685 |
| *A. (Stegomyia) africanus* ... | ,, ... | | | + | + | 1929, 1005 |
| *A. albopictus* ... ... | Asia ... | | | + | + | 1930, 486 |
| *A. angustivittatus* ... ... | S. America | | 0 | | | 1945, 114 |
| *A. apicoargenteus* ... ... | Africa ... | | | 0 | 0 | 1928, 848 |
| *A. dominicii* ... ... | S. America | | 0 | | | 1945, 114 |
| *A. fluviatilis* ... ... | ,, | 0 | 0 | + | + | 1931, 727; 1934, 77; 1938, 490; 1939, 25, 1945, 114 |
| *A. fulvithorax* ... ... | ,, | | | 0 | + | 1932, 197; 1938, 490 |
| *A. fulvus* ... ... ... | ,, | 0 | 0 | | | 1939, 27 |
| *A. geniculatus* ... ... | France ... | | | + | + | 1938, 117; 1939, 638 |
| *A. irritans* ... ... | Africa ... | | | 0 | + | 1933, 353 |
| *A. leucocelaenus* ... ... | S. America | + | +? | | | 1939, 27; 1942, 684; 1945, 114 |
| *A. luteocephalus* ... ... | Africa ... | | | + | | 1928, 848; 1942, 72; 1943, 602 |
| *A. metallicus* ... ... | ,, ... | | | + | | 1940, 552; 1942, 685; 1943, 602 |
| *A. nigricephalus* ... ... | ,, ... | | | 0 | + | 1933, 353 |
| *A. nubilus* ... ... ... | S. America | | | 0 | + | 1938, 490 |
| *A. podographicus* ... ... | ,, ... | | 0 | | | 1945, 114 |
| *A. punctocostalis* ... ... | Africa ... | | | 0 | + | 1933, 353 |
| *A. scapularis* ... ... | S. America | 0 | 0 | + | + | 1930, 484; 1934, 77; 1938, 490; 1939, 25, 27 |
| *A. variegatus* [*A. scutellaris*] | Asia ... | | | + | | 1930, 487 |
| *A. serratus* ... ... ... | S. America | 0 | 0 | 0 | + | 1930, 484; 1932, 197; 1939, 27; 1945, 114 |
| *A. sexlineatus* ... ... | ,, | | 0 | | | 1945, 114 |
| *A. simpsoni* ... ... | Africa ... | | + | + | + | 1929, 1005; 1941, 431; 1942, 759; 1943, 602 |
| *A. stokesi* (*apicoannulatus*) | ,, ... | | | + | | 1928, 848 |
| *A. taeniorhynchus* ... ... | S. America | | | + | + | 1930, 484; 1931, 727; 1938, 490; 1939, 25 |
| *A. taylori* ... ... ... | Africa ... | | | + | | 1942, 685; 1943, 602 |
| *A. terrens* ... ... ... | S. America | 0 | 0 | 0 | + | 1932, 197; 1938, 490; 1939, 27 |
| *A. triseriatus* ... ... | ,, ... | | | + | + | 1939, 639 |

*Transmission experiments were made by allowing the mosquitoes to bite a susceptible animal or by injecting an emulsion of their ground-up bodies into the animals. Both wild mosquitoes, as caught, and mosquitoes experimentally fed on an infected man or animal were used. *J. F. C.*

| Species | Country | Caught in nature | | Infected in lab'tory | | References *Tropical Diseases Bulletin* year and page |
|---|---|---|---|---|---|---|
| | | Bite | injn. | Bite | injn. | |
| *A. vittatus* ... ... ... | Africa ... | | | + | + | 1929, 1005 ; 1940, 552 |
| *A. whitmorei* ... ... | S. America | | 0 | | | 1945, 114 |
| *Eretmapodites chrysogaster* | Africa ... | | | + | + | 1928, 848 ; 1941, 431 |
| *Psorophora albipes* (*lutzii*) | S. America | 0 | 0 | | | 1939, 27 ; 1945, 114 |
| *P. cingulata* ... ... | ,, | | | | + | 1932, 197 ; 1939, 25 |
| *P. ferox* ... ... ... | ,, | 0 | 0 | + | + | 1932, 197 ; 1938, 490 ; 1939, 25, 27 ; 1945, 114 |
| *Haemagogus capricorni** [*H. janthinomys* ; *H. equinus* ?] | ,, | + | + | + | + | 1938, 491, 1939, 27 ; 1942, 684 ; 1944, 475 ; 1945, 114 |
| *H. uriartei* ... ... ... | ,, | | | 0 | + | 1938, 491 |
| *H. lucifer* ... ... ... | ,, | | 0? | | | 1945, 114 |
| *Wyeomyia bromeliarum* ... | ,, | | | 0 | 0 | 1931, 727 |
| *W. oblita* ... ... ... | ,, | | | 0 | 0 | 1931, 727 |
| *W.* sp. ... ... ... | ,, | | 0 | | | 1931, 727 ; 1945, 114 |
| *Dendromyia* sp. ... ... | ,, | | 0 | | | 1945, 114 |
| *Limatus durhami* ... ... | ,, | | 0 | 0 | 0 | 1931, 727 ; 1945, 114 |
| *Sabethes* sp. (3 species) ... | ,, | 0 | 0 | | | 1939, 27 |
| *Joblotia digitata* [*Trichoprosopon digitata*] ... | ,, | | | 0 | 0 | 1932, 197 ; 1933, 5 |
| *Joblotia* spp. [*Trichoprosopon* spp.] | ,, | | 0 | | | 1945, 114 |
| *Sabethoides serratoria* ... | ,, | | 0 | | | 1945, 114 |
| *Sabethoides* sp. ... ... | ,, | | 0 | | | 1945, 114 |
| *Sabethoides, Limatus, Wyeomyia, Goeldia, Trichoprosopon*—20 species, 88 specimens | ,, | 0 | + | | | 1939, 27 |
| *Culex fatigans* ... ... | | | | + | + | 1932, 197 ; 1934, 497 ; 1939, 25 ; 1941, 431 |
| *C. nigripalpus* ... ... | S. America | | | + | +? | 1938, 490 |
| *C. thalassius* ... ... | Africa ... | | | + | + | 1933, 4, 353 ; 1941, 431 |
| *Taeniorhynchus titillans* ... | S. America | | | | + | 1933, 5 ; 1939, 25 |
| *T. albicosta* ... ... | ,, | | | 0 | + | 1932, 197 ; 1938, 490 |
| *T.* (*Mansonioides*) *africanus* | Africa ... | | | + | + | 1930, 483 ; 1941, 431 |
| *T. chrysonotum* ... ... | S. America | | | 0 | + | 1932, 197 ; 1938, 490 ; 1939, 25 |
| *T. fasciolatus* ... ... | ,, | | | 0 | + | 1932, 197 ; 1938, 490 ; 1939, 25 |
| *T. justamansonia* ... ... | ,, | | | 0 | + | 1938, 490 |
| *T. uniformis* ... ... | Africa ... | | | 0 | + | 1933, 4 |
| *Anopheles albitarsis* ... | | | | | 0 | 1932, 197 |
| *A. gambiae* ... ... ... | ,, ... | | | 0 | 0 | 1930, 483 |
| *A. tarsimaculatus* ... ... | S. America | | | 0 | 0 | 1932, 197 |
| *Phlebotomus* sp. ... ... | ,, | | 0 | | | 1945, 114 |
| *Glossina morsitans*... ... | Africa ... | | | | 0 | 1942, 65 |
| *Stomoxys calcitrans* ... | S. America | | | + | + | 1935, 294 |
| *Amblyomma cajennense* ... | ,, | | | + | + | 1934, 80 |
| *Argas persicus* ... ... | ,, | | | 0 | + | 1934, 80 |
| *Boophilus microplus* ... | ,, | | | 0 | + | 1934, 80 |
| *Ornithodorus moubata* ... | Africa ... | | | 0 | | 1934, 80 |
| *O. rostratus* ... ... | S. America | | | + | | 1934, 80 |
| *Rhipicephalus sanguineus*... | ,, | | | 0? | + | 1934, 80 |
| *Cimex lectularius* ... ... | ,, | | | | + | 1930, 485 ; 1931, 292 |
| *C. hemiptera* ... ... | ,, | | | | 0 | 1930, 485 ; 1933, 5 |
| *Triatoma megista* ... ... | ,, | | | | + | 1931, 727 ; 1933, 353 |
| *Ctenocephalus canis* ... | ,, | | | 0 | + | 1935, 294 |

*Edwards (*Genera insectorum*, Diptera, Culicidae, Edwards 1932) ruled *H. equinus* (= *H. capricorni*) ; Dr. Neave, Director of the Imperial Institute of Entomology, has kindly given me the following information—" Most authorities treat *Haemagogus equinus* and *H. capricorni* as distinct species, with *janthinomys* as a synonym of the latter. The status of *spegazzinii*, Brèthes, is doubtful. Dyar, 1921, treated it as a synonym of *capricorni*, but Lane, 1939, . . . places it amongst his " *incertae sedis.*" Cerqueira [this *Bulletin*, 1944, v. 41, 782] regards it as a valid species with *janthinomys* as a synonym.

## SUMMARY OF RECENT ABSTRACTS.*

## VII. HELMINTHIASIS.

### *General.*

BURROWS (p. 408) has made a study of the intestinal parasites of the inmates of a mental hospital in South Carolina. The main point is that both the frequency and intensity of infestation in these patients increase with length of residence. Even among the attendants, those who deal with the more deteriorated patients show higher infestations than the others.

### *Trematodes.*

LUTTERMOSER and PIFANO (p. 590) have found eggs of *Schistosoma mansoni* in 78 per cent. of the inhabitants of one area of Venezuela. Here the conditions are optimum for the development of snails in the rivers, which are much used by the people. Measures of control are suggested, which include destruction of snails with lime when the soil is acid, or with copper sulphate or carbonate, the breeding of ducks and cleansing of waterways. Education, the raising of standards of agriculture, and treatment are other measures projected or advised. LUTTERMOSER (p. 592) states that infestation with *S. mansoni* has been found in 20 per cent. of autopsies at the Vargas hospital in Venezuela in recent years. He reports that snails, miracidia and cercariae can be killed by lime, which does not harm the cattle, and is a useful antibacterial agent.

In studying the course of experimental infection of mice with *S. mansoni*, MAYER and PIFANO (p. 591) have found that the worms are most likely to pass large numbers of eggs a short time after they have reached maturity—probably, in man, at about the time when dysenteric symptoms are likely to occur, 4–5 weeks after first infestation. In later stages, tissue reactions in the gut tend to obstruct the passage of eggs. The authors discuss infestations in which few or no eggs are passed, and conclude that these may be due to schistosomes predominantly of one sex. It has been shown that the cercariae which escape from a single snail are very often of one sex only, and it seems quite possible that man may acquire an infection confined to worms of one sex. Some degeneration of liver cells occurs in unisexual infestations, which may be due to immature worms and may be the basis of cirrhosis. [CORT (this *Bulletin*, 1923, v. 20, 220) suggests the view that sex in the schistosomes is differentiated in the miracidium, and that a snail infected by one miracidium, or by more than one, all of the same sex, will produce cercariae of one sex only.]

TRIM (p. 299) emphasizes the toxic symptoms which may be found in infections with *S. mansoni*, but which are not often seen in Africans. These may include high fever and there may be diarrhoea and acute abdominal pain, as in a case he describes. Another useful sign is the presence of discrete, rubbery glands in the groin.

GILBERT (p. 296), in a contribution on schistosomiasis of the female genital tract and neighbouring tissues, makes the point that in all his cases (in S. Rhodesia) the infection has been due to *S. haematobium*. Fibrotic reaction is very great, and often renders surgical procedures difficult. The urinary tract, of course, is commonly involved, but there have been a few recorded cases of ovarian disease, and the vagina is not uncommonly attacked. The

*The information from which this series of summaries has been compiled is given in the abstracts which have appeared in the *Tropical Diseases Bulletin*, 1944, v. 41. References to the abstracts are given under the names of the authors quoted and the pages on which the abstracts are printed.

uterus is not often affected, but may contain schistosome eggs. There may be papillomatous masses in and around the vulva. Infestation usually occurs early in life. Surgical treatment is often needed, since drug treatment, though necessary, cannot affect already formed fibrous tissue.

Di Prisco (p. 946) discusses the possibility that certain dermatoses—neurodermatitis, chronic prurigo and a form of pruritus—may be caused by infection with *S. mansoni*.

Plaza Izquierdo (p. 677) maintains that in Venezuela, Banti's disease is almost always due to *S. mansoni*, the infestation being mainly, or perhaps entirely, due to male worms. The parasites are not, however, found in the spleen, the enlargement of which is due to perisplenitis, infarction or portal obstruction. Splenectomy may give good results.

Ottolina and Atencio (p. 945) take the view that the methods used in Venezuela and elsewhere for the diagnosis of *S. mansoni* infection fail in a very large proportion of cases. They therefore attempted biopsy of liver, and searched for eggs after the specimen had been subjected to a simple digestion treatment. There is, however, a risk of haemorrhage in this procedure, and the authors therefore took biopsy specimens from the rectum. They found that these were always positive when the liver was positive, and that eggs were more numerous in the rectum than in the liver tissues. Rectal biopsy revealed 11 infections in 100 persons whose stools had been negative for eggs, and was also positive in certain patients thought to be cured after courses of tartar emetic. Biopsy is a simple and rapid procedure, and it is probable that if multiple biopsy were performed, a still higher incidence of infection would be revealed. It could be used to supplement skin and complement fixation tests.

Pifano and Mayer (p. 589) have investigated the Fairley complement fixation test in infections with *Schistosoma mansoni*; the hepatopancreas of infected snails was used as a source of antigen. The reaction was positive, in a few cases, as early as the beginning of the third week after contact with infested water; later, when the disease was established, it was positive in 97 per cent. of cases, and in the late stages the reactions were strongly positive. The test is, therefore, valuable. It permits the diagnosis of a trematode infection and points to infection with a schistosome, but the fact that it is occasionally negative in proved cases of schistosomiasis mansoni shows that it cannot be relied upon completely to exclude that disease.

The National Research Council of the United States (p. 222) have issued a summary of current literature on anthiomaline, which, though used in several diseases, is particularly valuable in schistosomiasis.

Goodwin and Page (p. 222) have investigated the excretion of the catechol portion of the Stibophen (Fouadin) molecule. This is quicker than excretion of the antimony portion. The function of catechol appears to be to keep the circulating antimony in solution in a non-toxic form while it is being absorbed by the liver or excreted by the kidney.

Gelfand and Osburn (p. 137) describe katayama, a syndrome which may occur in schistosomiasis, and which is well recognized in Japan and Egypt. It usually begins 4–6 weeks after exposure to infected water, and consists of irregular fever, urticaria and eosinophilia. Several cases have been seen in S. Africa. The authors point out that there may be considerable difficulty in diagnosis.

Li and Chien (p. 56) report a case of chronic intussusception of the caecum into the colon, associated with the presence of eggs of *Schistosoma japonicum* and ulceration of the mucosa. They think that the eggs caused the ulceration and that this led to local spasm and to intussusception.

Szidat (p. 57) discusses *Cercaria ocellata*, a cause of schistosome dermatitis in man; he concludes that several species are included under this name, and

describes three other cercariae from *Limnaea palustris*, and several from other snails. He points out that spread of cercarial dermatitis in open bathing places in European big towns is to be expected as the urbanization of wild aquatic birds (ducks, gulls, swans) increases; most of the 11 species of schistosomes found in Europe are parasites of birds.

MacFarlane (p. 947) has investigated swimmers' itch in New Zealand. Three types of lesion are found :—macules in those not previously infected, papules in those who have previously been attacked, and (in one case) macules with pruritic oedema. There was some evidence of immunity in persons previously infected, and this was sometimes local in areas of thick skin. On the other hand, general immunity was shown by some who had never been infested. The parasite is closely related to *Cercaria elvae* and *C. ocellata*, but appears to be a new species and is named *C. longicauda*. It penetrates the Malpighian layer of the skin, but does not pass into the dermis. In 75 hours after infection, biopsy specimens show that all traces of the cercariae have disappeared. Several snail hosts have been found; the vertebrate hosts are probably ducks.

Neghme and Ossandon (p. 300) report a case of human infection by *Fasciola hepatica*, in which one fluke was found in the subcutaneous tissue over the right eighth rib, three weeks after operation for gall stones, and in which the presence of another in the liver was inferred because eggs continued to be passed in the faeces. *F. hepatica* has not often been found in man, and the authors refer to the literature on the subject, in which some 150 cases are recorded. Ectopic localization of the flukes is much more rare. The condition of the patient now reported improved after a course of emetine injections.

Valdés Dapena and Pérez Hurtado (p. 1052) give an account of a case of infestation with *F. hepatica*, in which the patient had daily fever with rigors, and pain and tenderness in the right hypochondrium. No parasites were found in the faeces, but eggs of *F. hepatica* were present in bile obtained by duodenal intubation.

Morenas (p. 677) reports infection with *Fasciola hepatica* in several members of two families in the Roanne region of France, and suspected infection in others. He tested these families, and a series of controls, with a scratch test and an intradermal test, in which the antigen was prepared from fresh flukes obtained from cattle. The results were suggestive, but positive reactions were given by some of the controls.

Laurent *et al.* (p. 760) report two more cases of infestation with *Fasciola hepatica* in Tunisia. They point out the danger of eating cress from unknown sources, and advise that, in suspected cases, bile obtained by duodenal intubation should be examined.

Miller and Wilbur (p. 497) report seven cases of paragonimiasis in members of the United States forces who have been in Samoa and the Solomon Islands. The clinical features included persistent cough, pain in the chest, and expectoration of sticky, colourless sputum containing brown flecks. Only one patient had haemoptysis.

Cameron (p. 761) has given an account of the morphology, taxonomy and life history of *Metorchis conjunctus*, a trematode which has been found in man and other animals. The intermediate hosts are snails and a fresh water fish. This trematode is found widely in Canada, especially in mink and red fox. Details should be sought in the original abstract.

### *Cestodes.*

von Bonsdorff (p. 593), in his investigations of the relationship between *Diphyllobothrium latum* and pernicious anaemia, has shown that the worm contains a substance capable of inhibiting the activity of the protease of gastric juice which is active at *p*H 5 to 9 and above, and which is supposed to be the

so-called intrinsic factor. He (p. 594) points out that the proteolytic gastric enzyme active at neutral reaction is present in *D. latum* anaemia, as it is in cryptogenic pernicious anaemia. The same author (p. 594) shows that after expulsion of the worm, in infected persons with pernicious anaemia, there is usually a definite reticulocyte response and blood regeneration. In these cases the anaemia is due to the parasite, but in other cases the association is only accidental.

The same author (p. 678) has shown that, if patients harbouring *D. latum* are maintained on a diet poor in the extrinsic factor of Castle, the removal of the worm does not lead to increase of reticulocytes or of red cells. If, however, substances rich in this factor are added to the diet, there is a strong reticulocytosis and improvement in the blood values. The intrinsic factor was evidently present in these cases.

Tötterman (p. 858) has shown that the Price-Jones curve in tapeworm anaemia [presumably due to *D. latum* infection] agrees exactly with that of cryptogenic pernicious anaemia.

Hirvonen (p. 594) has made a study of the serum iron in cases of infestation with *D. latum* and *Taenia saginata*. The details should be sought in the original abstract.

de Meillon and Leech (p. 301) report a case of sparganosis from Uganda. The sparganum was found in one of several small nodules in the connective tissue round the spermatic cord during an operation for inguinal hernia. The species of the worm was not determined. The authors suggest that sparganosis may be more common in Africa than the meagreness of reported cases suggests; in general, the majority of recorded cases are from the Far East.

Duguid and Sheppard (p. 857) describe an epidemic in trout (in S. Wales) due to plerocercoids of a tapeworm belonging to the Diphyllobothriidae. The worm was not definitely identified, and there is some discussion as to whether or not it was *D. latum*. Hickey and Harris (p. 858) note that trout from reservoirs near Dublin are infested with plerocercoids; the matter is being investigated.

Podyapolskaya (p. 301) has found that a method of examination which involves taking scrapings from the perianal folds (as in the diagnosis of *Enterobius* infections) is a more accurate means than faecal examination for detecting the presence of *Taenia saginata*. The value of this method depends upon the fact that when the segments of the worm move, they leave behind a trail of eggs; the scrape method therefore depends upon the characteristic crawling habit of *T. saginata*, and does not apply to infestations with *T. solium*. Faecal examination is more efficient in detecting infestations with *Trichuris*, *Ascaris* and *Hymenolepis*.

Gaehtgens (p. 138) discusses the serological diagnosis of *Taenia* infections. These are not useful in tapeworm infections of the intestine, but are valuable in echinococcosis. In suspected cysticercosis, important diagnostic aid may be obtained from the examination of blood and cerebrospinal fluid by complement fixation and precipitin methods; antigen is prepared from pig cysticerci. Flocculation tests are also useful. Sera of patients with cysticercosis may also react with *Echinococcus* antigen, but differentiation is possible by the kaolin adsorption technique.

Prior (p. 58) reports a case of cerebral cysticercosis in a man who had no previous history of epilepsy, but who passed into the condition of status epilepticus during an attack of pneumonia, and died. The cysts were not disintegrated or calcified, and the author thinks that, under the influence of the acute systemic disease, they probably imbibed fluid and became tense, thus causing symptoms. Bernales and Encinas (p. 58) describe a case in which many cysticerci were found in the ponto-cerebellar area, and in which

there were signs of lesions of various cranial nerves, the cerebellum, pyramidal tracts, and finally signs of bulbar compression.

Holman and Pierson (p. 762) do not regard as reliable either the intradermal or the complement fixation test for hydatid disease. They point out also that the disease may be present for years, and that organs may be extensively involved, before symptoms are caused. They quote three cases to illustrate these points.

Graña (p. 764) has found that, in the serum of patients with hydatid cysts, who have been given subcutaneous injections of hydatid fluid, there is a great increase of haemolysins and agglutinins for sheep red cells. It seems that previous sensitization of the tissues is necessary for the production of these heterophilic antibodies, which appear to be of a new type.

Kevorkov (p. 498) has considered the possibility that man may become infested with *Hymenolepis murina* of the rat, and thinks that this is possible, in spite of the fact that in Russia there is little coincident infestation, with *Hymenolepis* of man and rodents, though it does occur in some parts. He (p. 498) notes that tens, or even hundreds, of thousands of *Hymenolepis nana* may be found in a human patient, especially if the patient is a child. He discusses treatment, and concludes that this should be given only if there are symptoms. Male fern is used, but should preferably be given by a fractional method. Ionina (p. 499) does not regard treatment of *Hymenolepis* infestation with male fern by the standard methods as efficient. A new method is needed.

Larsh (p. 764) has succeeded in inducing a degree of immunity against *Hymenolepis nana* var. *fraterna* in mice by intraperitoneal injection of fresh worm antigen. This immunity is transmitted by artificially immunized female mice to their young, but in them is not so high as in young mice suckled by mothers with actual infestation with the living worms.

Larsh (p. 765) has studied in mice the relationship between splenectomy and resistance to infection with *Hymenolepis nana* var. *fraterna*. Details are given in the original abstract. *Charles Wilcocks.*

[*To be continued.*]

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## MALARIA.

British Guiana. **Report of the Malaria Investigations Service of the Medical Department, British Guiana, for the Year 1943** [Bevier, G., Director, Malaria Research Unit]. 103 cyclostyled pp., 2 charts.

The almost complete disappearance of *A. darlingi*, the only known vector of malaria in the coastal belt of British Guiana, consequent upon the prolonged drought of 1938–1941, has been described in previous reports [this *Bulletin*, 1943, v. 40, 512]. In December 1942, nearly 40 inches of rain fell, and another 80 inches during the first half of 1943, the latter being 28·60 inches above the sixty-year average for these six months. *A. darlingi* became very prevalent and the incidence of malaria abnormally high, epidemic in places. The morbidity returns of medical districts and estate hospitals indicate the east to west march of infection, or spread of *A. darlingi*.

The results of spleen and parasite surveys of school children in different parts of the colony are reported in detail.

*East Bank Berbice Estuary, July* 1943.—Spleen rate 57·3; parasite rate 70·0. *P. falciparum* 64·7, *P. vivax* 13·3, *P. malariae* 4·7 per cent. of positive slides; in the remainder identification was doubtful. East Indians had higher spleen rates and larger spleens but lower parasite rates than had Negroes. This was a general observation.

*East Bank Demerara Estuary, July* 1943.—Spleen rate 37·3 ; parasite rate 41·9. *P. falciparum* 45·5, *P. vivax* 28·5, *P. malariae* 7·3, per cent. of positive slides ; remainder doubtful.

*West Bank Demerara Estuary, September–October* 1943.—Spleen rate 58·5 ; parasite rate 48·9. *P. falciparum* 38·4, *P. vivax* 31·2, *P. malariae* 2·7 per cent. of positive slides.

*West Coast Demerara, October* 1943.—Spleen rate 14·6 ; parasite rate 22·0 ; rates indicative of malaria of recent introduction.

The spleen and parasite rates in Georgetown City are referred to in another report (see below).

The total number of anophelines captured during 1943 was 12,768, of which *A. darlingi* were 96·05 per cent., *A. tarsimaculatus* 2·59, *A. albitarsis* 0·71 and *A. triannulatus* 0·65 per cent. In the drought years 1940 and 1941 *A. tarsimaculatus* had been as numerous as *A. darlingi*. *A. albitarsis*, when disturbed in grass or bushes near its breeding grounds, may attack during the day. *A. triannulatus* prefers the blood of mules and cows to that of man. *A. tarsimaculatus* is more likely to be taken in evening than in morning catches and it prefers animal to human bait : this species was not only relatively but actually less numerous in 1943 than it had been in the drought years. "*A. tarsimaculatus*" may consist of more than one species ; its preference for breeding in salt waters may explain its greater prevalence in drought years. *A. darlingi* shows a decided preference for human blood. It is more frequent in morning than in evening captures ; it enters dwellings during several evening hours and seldom leaves before the day is well advanced. Where it has been established for some time the seasons of its maximum prevalence are from December to March and from July to September.

Most surface waters along the coast of British Guiana are artificial—canals, drainage ditches, rice fields, flooded cane fields, ponds and borrow pits. The exceptionally heavy rain in the first half of 1943 changed the usual characteristics of surface waters ; the black water usually characteristic of canals was absent ; the saline content which had been so high during drought years fell to normal. During the year observations were made on 11,199 ground water collections for the presence of larvae, saline content, reaction, and other characteristics. In all, 21,467 larvae were identified. A large amount of information was obtained regarding the breeding habits of *Anopheles*, of *A. darlingi* in particular. Acid and brackish waters are not favoured by this species. A field laboratory has been opened in which these observations can be continued and extended under controlled conditions.

Dr. Jardine, the medical officer of the Demerara Bauxite Company at Mackenzie, 65 miles up the Demerara River, reports a gradual increase in the number of malaria cases since 1942. Anophelines have also increased since 1941, particularly *A. darlingi*. Among anopheline larvae found *A. triannulatus* is most abundant ; *A. darlingi* comes second, about 20 per cent. *A. apicimacula*, *A. kompi* and another species, which do not occur on the coast, are found at Mackenzie.

An ecological study of the vegetation of flood fallows on ten sugar estates along the coastal portion of British Guiana was carried out by D. B. Fanshawe : his report is included. *Norman White.*

Giglioli, G. **Malaria in the City of Georgetown and its Suburbs.** 54 cyclostyled pp., 1 plan. [C.O. Ref. No. 60286/45 dated 23rd March, 1945.]

This is a very comprehensive malaria survey report of the City of Georgetown, British Guiana ; it records the results of observations carried out over a number of years. Some of these years were very abnormal. Deficient rainfall amounting

to drought occurred from September 1938 to June 1941. The year 1943 had a record high rainfall of 122 inches.

Georgetown lies on the Atlantic Coast on the right bank of the Demerara River estuary. The municipal area covers 2⅛ square miles and has a population of about 73,000. The adjacent suburbs to the east and south-east harbour about 12,000 people. Thus the urban and suburban population combined is almost a quarter of the total population of British Guiana. For the eleven-year period, 1933–1943, the average vital statistical rates for the municipal area were : birth rate 28·1 ; death rate 18·7 ; infant mortality rate 106.

The only vector of malaria in British Guiana is *A. darlingi*. There are no suitable breeding places for this mosquito within the city proper. In the suburbs, however, and in adjacent sections of certain city wards, malaria is endemic or hyperendemic. From September 1940 to November 1942, *A. darlingi* completely disappeared from the Georgetown area as a result of the drought. In the early part of the drought parasites were still to be found in a large proportion of children in certain areas, and *P. malariae* infections were most in evidence. By the end of 1943 *A. darlingi* had become once more very prevalent ; it was breeding in abundance all round the city. The incidence of malaria in some suburban areas reached epidemic proportions, probably because of the loss of immunity during the healthy drought years. Gametocyte carriers were abnormally numerous. At this time 1,377 children were examined in the suburbs and adjacent city areas ; the spleen rate was 29·3, the parasite rate 48·1, and the gametocyte rate was 10·4 per cent. In the worst area a parasite rate of 82·3 per cent. was found. By August 1944 the epidemic had spent itself and the severe endemicity of pre-drought years prevailed once more.

The malaria problem is very serious in the southern suburbs and wards of the city. The chief breeding sites of *A. darlingi* are nearly all outside the inhabited fringe, notably in Le Repentir Cemetery and in rice grounds and cane fields. The author believes that breeding in the cemetery might be controlled by flooding its whole drainage system with sea water. The eggs of *A. darlingi* die in water containing more than 6 gm. NaCl per litre ; in water containing up to 3 gm. per litre *A. darlingi* may develop normally. The water in the estuary which receives the effluent from the Cemetery has a saline content of from 20 to 25 gm. per litre in the dry weather and from 8 to 12 gm. in the rainy season.

The breeding in rice grounds and cane fields will be more difficult to control. Intermittent flooding of the former so that they never contain water for more than six consecutive days might succeed.

In the eastern suburbs and adjacent city wards malaria is not so severe as in the south, but the multiplicity of breeding places in these semi-rural settlements complicates control measures. Irrigation in the north-eastern suburbs is from a canal with water of high acidity. The acidity decreases on standing and by dilution with rain water, and conditions quickly become favourable for *A. darlingi* breeding. Should it be possible to retain the acidity of the irrigation water by controlled drainage and more frequent intake less breeding would probably take place.

Spray killing of adult mosquitoes with the new insecticides in houses on the fringe of the city might give important results. The habits of *A. darlingi* render it very vulnerable to such a form of attack.

During the first eight months of 1944 all but one of the 3,377 adult anophelines captured in houses in the Georgetown area were *A. darlingi*. The solitary exception was *A. tarsimaculatus*. The Yellow Fever Service, in 95 routine inspections of trains coming in from the East coast, collected 41 *A. darlingi*, 620 *A. tarsimaculatus*, 43 *A. albitarsis* and 3 *A. triannulatus*. All four species breed in profusion in the Georgetown area, but *A. darlingi* alone frequents human habitations.

In the parasite survey of 1,377 children carried out from December 1943 to February 1944, malaria parasites were found in 666, or 48·1 per cent. The species were *P. vivax* 199, *P. falciparum* 251, *P. malariae* 11, 226 ring forms of doubtful identity, 18 double infections and two triple infections. Gametocytes were found in 51·8 per cent. of the *P. falciparum* positive slides. The low incidence of *P. malariae* is in striking contrast to the findings in the same areas in the drought year 1940, when *P. malariae* was found in 65 per cent. of all positive slides. *Norman White.*

Trinidad Government-Rockefeller Foundation. **Malaria. Annual Report, 1943, of the Co-operative Work in Trinidad and Tobago, B.W.I.** pp. vii+70, numerous figs., sketch maps & photos. 1944. Govt. Printers.

A malaria survey report of Trinidad and Tobago was summarized in this *Bulletin*, 1944, v. 41, 445. The present report carries the story still further and details the work carried out in 1943.

The Government malariologist (H. P. S. Gillette) reports on school surveys, the slide diagnostic service, treatment centres and field and control activities. Eighty-four schools in scattered areas were examined: 9,987 children were examined for splenomegaly and 4,800 blood slides were examined. The malaria incidence was lower in 1943 than in 1942. Very remarkable results have been obtained in the Toco area in the County of St. David in the north of the Island of Trinidad by attention to the prolific breeding of *A. aquasalis* in water dammed up in blocked river mouths during the dry season. What was an area of hyperendemicity now shows spleen and parasite rates of low endemicity. In three schools the spleen rates in 1941 were 81·5, 72·0 and 71·1; in 1943 these rates had fallen to 12·1, 8·3 and 20·8. Formerly parasite rates were higher than spleen rates; in 1943 the reverse was the case. In one school the parasite rate had fallen from 81·6 per cent. to nil.

The slide diagnostic service is of great value to practitioners and provides interesting information concerning the prevalence of malaria in different parts of the colony. During the nine months in which the service was in operation, 14,117 slides were received. Malaria parasites were found in 5,524; 72·9 per cent. *P. falciparum*, 23·7 per cent. *P. vivax*, 2·1 per cent. *P. malariae* and 1·2 per cent. mixed infections. *P. vivax* infections were most in evidence in April and May.

R. C. Shannon describes investigations on *A. aquasalis* during the year. Most of the villages bordering on the Caroni and Laventille swamps have very low malaria rates in spite of the enormous quantities of *A. aquasalis* breeding throughout most of the year. The low malaria rates are attributed in large part to the strongly zoophilic disposition of the species. In a large buffalo stable near one of these villages tens of thousands of *A. aquasalis* may be found nightly. In two other villages where domestic animals are few, high spleen indexes have been noted. In these villages there appears to be a significant correlation between the ratio of animals to man and the spleen rates. Donkeys and probably mules and horses are as attractive to *A. aquasalis* as are buffaloes and cows. Some interesting details are given concerning the trapping of *A. aquasalis* in an animal-baited "dawn trap", the construction of which is illustrated. *A. aquasalis* has two dominant tendencies, to enter stables and houses at night to feed and to depart from buildings at dawn. Experiments are being made as to the possibility of reducing malaria in certain villages by means of these traps. With regard to the breeding of *A. aquasalis* it was found that floatage is essential for heavy breeding, and that the *p*H of the water had little influence. It has been found breeding in waters with a *p*H of 3·7 and of 8·0.

In the wetter portions of Trinidad *A. bellator* is responsible for the high incidence of malaria on cacao estates. It breeds in bromeliads which parasitize

immortelles, the shade trees, on the plantations. A discussion of the bromeliads and the bromeliad-anophelines by C. S. PITTENDRIGH occupies about a third of the space in this annual report. Ecological studies have been continued. Some experiments were begun with a heavy spraying equipment (the Gypsy Moth Sprayer), using a copper sulphate solution, to destroy bromeliads. No bromeliads were too high for the equipment to reach, and they were destroyed, but some damage was done to cacao leaves. Further experimental work is necessary. One species of bromeliad alone, *Gravisia aquilegia*, supports almost all the *A. bellator* of cacao estates. Selective hand removal of this species may be economically possible. Owing to the present slump in the cacao industry in Trinidad the trees in a large part of the island have been practically abandoned. A replanting scheme is being considered by the Agricultural Department. It might be possible to dispense with shade trees ; Cacao has been profitably grown elsewhere without the use of other trees for shading. A joint committee of the Agricultural and Health Departments and the Rockefeller Foundation is considering the matter. *Norman White.*

JASWANT, SINGH & JACOB, V. P. **Malaria Investigations in North Kanara.** *J. Malaria Inst. of India.* 1944, June, v. 5, No. 3, 267–303, 2 charts & 2 maps. [14 refs.]

This is a record of a year's observations in the North Kanara District, the southernmost district of the Bombay Presidency, with a coastline on the Arabian Sea of about 75 miles. The district lies between 13° 15′ and 15° 32′ N. and between 74° 7′ and 75° 10′ E. There is a coastal strip from 3 to 10 miles in width which is crossed by four rivers which form estuaries and numerous backwaters along the coast. Eastward the coastal strip merges into the foothills, some 10 to 15 miles in width and some 200 feet above sea level. To the east again hills attain a height up to 2,500 feet ; they are covered with evergreen forest and perennial streams flow through narrow winding valleys. Still further inland the upland area becomes open and flat. The climate is equable, with no extremes of heat or cold ; the seasons are not well marked, except the rainy season. The average rainfall is 107·5 inches, of which 90·5 inches fall during June, July and August, the south-west monsoon. The population is 441,000.

In most of the coastal belt there is but little endemic malaria, spleen rates under 5 per cent. being the rule. In the foothills malaria is severely endemic, hyperendemic in places. Spleen rates of 80 per cent. and over were recorded in several villages. In the interior of the district malaria is generally hyperendemic, with but few exceptions.

Two parasite surveys were carried out, 1,890 and 1,587 children being examined. They disclosed parasite rates of 21·6 and 17·8 per cent. respectively. *P. malariae* is the most prevalent species of parasite, 58·2 and 63·7 per cent. of positive findings in the two surveys. The remainder were *P. vivax* and *P. falciparum* infections, the former being slightly more numerous than the latter. Transmission may occur during any month but is less active from July to September than at other times.

The following species of *Anopheles* were identified :—

| | | |
|---|---|---|
| *A. fluviatilis* | *A. tessellatus* | *A. maculatus* |
| *A. culicifacies* | *A. annularis* | *A. stephensi* |
| *A. jeyporiensis* | *A. hyrcanus* | *A. theobaldi* |
| *A. pallidus* | *A. varuna* | *A. turkhudi* |
| *A. subpictus* | *A. barbirostris* | *A. culiciformis* |
| *A vagus* | *A philippinensis* | *A aitkeni* |
| *A. jamesi* | *A. splendidus* | *A. insulaeflorum* |
| *A. karwari* | *A. leucosphyrus* | |

*A. fluviatilis* was the only species incriminated as a vector. It was never found in large numbers, either as a larva or as an adult. It favours human dwellings as resting places. Slow running streams with marginal vegetation are preferred as breeding places but occasional breeding takes place in a variety of places but always in close proximity to human habitations. Of 88 engorged females 56 contained human blood, and 32 the blood of cattle. Of 897 specimens dissected, oöcysts or sporozoites were found in 99, an infection rate of 11 per cent. *A. fluviatilis* is rare in the coastal belt, a fact that accounts for the low malaria endemicity there.

*A. culicifacies*, which MHASKAR (1915) had reported to be the malaria vector in North Kanara, does not appear to play any important rôle. Eight hundred and twelve were dissected without any evidence of infection. Precipitin tests on 48 specimens gave positive results in 42, all cattle blood.

Of 255 *A. annularis* dissected none was infected.

Spray-killing of adult mosquitoes should prove of value in the control of malaria in North Kanara. *Norman White.*

ABRAHAM, A. C. & SAMUELS, R. D. **Epidemiology of Malaria in the Nizamsagar Ayacut Area, Nizamabad District, Hyderabad State.** *J. Malaria Inst. of India.* 1944, June, v. 5, No. 3, 305–18, 1 map & 2 graphs.

The Nizamsagar Irrigation Project was completed in 1933. A masonry dam, two miles long, was built across the valley of the river Manjra, forming a reservoir with an area of 50 square miles. A main canal 98 miles long, with 1,100 miles of distributaries, can irrigate 275,000 acres of land. Water is supplied throughout the year; there are two crops of rice annually. The advent of irrigation led to increased malaria incidence, for which inadequate drainage, faulty construction and inadequate maintenance, seepage, and borrow pits have been responsible.

Adult anophelines captured and identified numbered 57,281 :—

| | | | |
|---|---|---|---|
| *A. subpictus* | 33,727 | *A. tessellatus* | 51 |
| *A. annularis* | 16,947 | *A. barbirostris* | 33 |
| *A. culicifacies* | 3,194 | *A. jamesi* | 21 |
| *A. hyrcanus* | 1,004 | *A. stephensi* | 8 |
| *A. fluviatilis* | 984 | *A. splendidus* | 8 |
| *A. aconitus* | 943 | *A. theobaldi* | 5 |
| *A. vagus* | 217 | *A. turkhudi* | 2 |
| *A. pallidus* | 137 | | |

The chief malaria vector is believed to be *A. fluviatilis*, but of 177 dissected only one was found infected. It was found breeding extensively in the canal distributaries and the smaller channels, as well as in rainwater pools and seepages. *A. culicifacies* probably plays some part in malaria transmission; of 1,442 dissected none was infected.

The spleen rate of 1,145 children examined between September and January was 43.8 per cent. Male children had higher spleen rates than females; they wear fewer clothes.

Parasites were found in 396 of 865 slides examined, 45·8 per cent. : *P. malariae* 153; *P. vivax* 119; *P. falciparum* 101; mixed infections 23.

Malaria is least prevalent during the months of heaviest rainfall, June and July. The numbers of *A. fluviatilis* and *A. culicifacies* captured during May, June and July were lower than in any other months.

A malaria control scheme was put into operation in 1942; the results have been encouraging. The spray-killing of adult mosquitoes, the use of oil and of paris green as larvicides, minor engineering works, the stocking of selected mosquito breeding places with *Gambusia*, and prophylactic administration of quinine in certain hyperendemic villages, are the measures employed. *Norman White.*

YACOB, M. & SWAROOP, S. **Degree of Accuracy realized in Malaria Forecasts in the Punjab for the Years 1923 to 1942.** *Indian Med. Gaz.* 1944, June, v. 79, No. 6, 282–9.

—— &——. **The Forecasting of Epidemic Malaria in the Punjab.** *J. Malaria Inst. of India.* 1944, June, v. 5, No. 3, 319–35, 1 map.

The low-lying plains of the Punjab which are liable to inundation as the result of abnormally heavy monsoon rainfall and the consequent overflow of rivers and stormwater channels have been afflicted by widespread epidemics of malaria at intervals sometimes of many years. GILL [this *Bulletin*, 1928, v. 25, 753] described a method of forecasting such epidemic manifestations of malaria, and his method has been used continuously ever since. In these papers a statistical evaluation of the accuracy of these forecasts supports the conclusion that malaria epidemics in the Punjab can be predicted with considerable precision.

The forecasts are issued at the end of August or beginning of September and relate to the events of the subsequent months. October is the month with the maximum mortality from "fevers" in the Punjab. The factors favouring epidemic manifestations of malaria in any locality are: marked excess of July-August rainfall over the normal, or extensive floods; an epidemic potential above 60; a relatively low spleen rate in June compared with previous years; and conditions of scarcity during the preceding year as reflected by the high cost of staple foods. The epidemic potential factor indicates the relative liability of districts to epidemic visitations. The standard deviation of deaths from "fevers" during the month of October in each district was multiplied by 100 and the product divided by the number of years that had been taken into account (53 years). Where the epidemic potential is very low no appreciable epidemic is likely to occur; if it be over 60 an intense epidemic might occur.

For expressing the intensity of an epidemic an index called the "epidemic figure" is worked out. The average monthly "fever" deaths during October, November and December of any year, are divided by the mean monthly "fever" mortality figure for the four months April to July, of the same year. Regional malaria epidemics in the Punjab occur exclusively in the autumn. This epidemic figure is based solely on malaria mortality; malaria morbidity figures are unobtainable. The index is, therefore, not a wholly reliable index of malaria incidence.

[Though the contention that accurate predictions are possible may be conceded, their very accuracy seems to show that they have served but a very limited useful purpose; otherwise they could have been falsified more often by appropriate action.] *Norman White.*

RAO, G. R. **Malaria in the Jharia Mining Settlement, Bihar. Parts II, III & IV.** [Abstract.] *J. Malaria Inst. of India.* 1944, Dec., v. 5, No. 4, 471.

RUSTOMJEE, K. J. **Observations upon the Epidemiology of Malaria in Ceylon.** [Abstract.] *J. Malaria Inst. of India.* 1944, Dec., v. 5, No. 4, 469–70.

FAUST, E. C., SCOTT, J. A. & MCDANIEL, G. E. **Malaria Mortality and Morbidity in the United States for the Year 1943.** *J. National Malaria Soc.* Tallahassee, Fla. 1945, Mar., v. 4, No. 1, 66–76. [19 refs.]

This report is based on information supplied by the bureaux of vital statistics of all the States of the United States, regarding deaths attributed to malaria. Morbidity statistics are also included but these, for the most part, are necessarily very incomplete. The malaria mortality rates for the United States as a whole and for the malarious south-eastern States are the lowest on record The total number of malaria deaths was 622, 0·47 per 100,000. Of these deaths 92·6 per cent. were reported from the Southern States. In Mississippi and North

and South Carolina statewide blood-film surveys have been carried out. From the results of such surveys it is estimated that there are at least 300,000 infected individuals in the Southern States and probably 100,000 more in the more mildly endemic States. A recrudescence of moderately high endemicity took place in the eastern half of Oklahoma. In most States, particularly in the north, *P. vivax* infections predominate. In North Carolina *P. falciparum* and *P. vivax* infections are about equally prevalent. In Georgia *P. falciparum* was more commonly diagnosed than *P. vivax* in the proportion of 1·65 to one.

Attention is called to the dangers arising from the return of *vivax*-infected troops; the presence of infected prisoners of war in localities in which vector species of *Anopheles* breed; the return of infected merchant seamen and civilians; the existence of malaria among drug addicts; and an increasing danger of malaria being contracted from blood transfusion.

*Norman White.*

Renkonen, K. O. Ueber das Vorkommen von Malaria in Finnland. [**The Incidence of Malaria in Finland.**] *Acta Med. Scandinavica.* 1944, v. 119, No. 3, 261–75, 7 charts. [18 refs.]

The seasonal incidence of malaria in Finland from 1892 to 1943 is described and is compared with that of Sweden from 1861 to 1940; in both cases the official records have been employed.

Graphs showing the number of cases month by month are remarkably similar for the two countries; the incidence curve is at its lowest in December, January, and February; then it rises steeply, reaching its highest peak in May; it falls sharply till July or August and then gradually till December.

A separate curve shows that in Sweden since 1901 the seasonal incidence has changed; the curve is much flatter; its highest point is still in May but there are two lower secondary peaks, one in October, and the other in January. This curve is based on the much smaller number of cases that have occurred yearly since 1901, as compared with the earlier years.

The seasonal incidence in more southerly countries is illustrated by a graph for Wilhelmshaven, Germany, where there is a spring peak in May, a fall to a low level in July, and a high autumn peak whose apex is in September.

The spring peak in Finland, Sweden, North Germany, and Holland, comes with remarkable uniformity in the month of May; it seems to be little affected by differences in temperature during the month of April.

On the other hand the temperature during April had a considerable influence on the number of cases that occurred during the high spring peak in Finland and Sweden. In the years in which the April temperature was higher than the average the total number of cases was 26 to 36 per cent. less than in the years with lower temperatures.

The influence of the temperature in the month of September of the preceding year has also been studied; there were great differences in the results observed, but on the whole it appears that the average number of cases in the years preceded by a warm September tends to be distinctly higher than in the years preceded by a cool September.

The combined influence of the temperatures in April and the previous September is shown by the following table prepared from the Swedish records covering a period of 80 years:—

| *Temperature conditions.* | *Average yearly number of cases.* |
|---|---|
| September cold and April cold ... ... ... | 1,876 |
| ,, ,, ,, warm ... ... ... | 1,510 |
| September warm and April cold ... ... ... | 2,139 |
| ,, ,, ,, warm ... ... ... | 1,011 |

It will be seen that the temperature in April has a more pronounced influence than that of the preceding September, and the author suggests that this influence is best explained by the circumstance that when the weather is cold in April the people remain longer exposed to the bites of infected over-wintering mosquitoes than when April is warmer. It is also suggested that the findings are inconsistent with the view that the spring peak of incidence is explained by the occurrence of a prolonged incubation period following infection acquired in the previous autumn.

Graphs are reproduced to show the remarkable decline in the incidence of malaria in Sweden and Finland. Since 1910 the number of cases in any year has been negligible in Sweden, where, up to 1881, the yearly number of cases usually ranged from 4,000 to 8,000.

In Finland it is believed that in 1820 no less than 1,044 persons died of the disease; the total population at that time was 1,177,500. The only considerable epidemic in recent times in Finland was in 1902 when 3,300 cases were registered; in each of the years 1920 and 1921 there were about 500 cases, otherwise since 1910 the disease has been almost non-existent.

The decline in both countries is attributed to improved economic and cultural conditions; no great change has occurred in the degree of human association with cattle and other domestic animals.

The only vector mosquito found in Finland is *Anopheles maculipennis* [*typicus* and *messeae* according to Ekblom, *Bull. Soc. Path. Exot.*, 1938, v. 31, 647], which occurs all over the country. *John W. D. Megaw.*

Moshkovski, S. D. [**Quantitative Laws of Malaria Epidemiology. Sixth Communication. The Dynamics of Malariometric Values. Part I.**] *Med. Parasit. & Parasitic Dis.* Moscow. 1944, v. 13, No. 4, 3–25, 21 figs. [In Russian.]

Sergiev, P. G. & Tiburskaya, N. A. [**The Peculiarities of Strains in** *P. vivax*.] *Med. Parasit. & Parasitic Dis.* Moscow. 1944, v. 13, No. 5, 36–47, 2 figs. [In Russian.]

The authors compare two strains of *P. vivax*, one isolated in Nakhichevan, in southern Russia (their "Southern" strain); the other from Moscow province (the "Northern" strain). Parasite counts made at different periods of the infection in 32 paretics, who were divided into two groups experimentally infected with the "Southern" (17) and "Northern" (15) strains respectively, showed that these strains differed considerably in the number of parasites produced in the course of the infection. In the case of the "Northern" strain the mean number of parasites per count was 478·9 (1,604,370 parasites in 335 counts), whereas the mean number in the "Southern" strain was 186·6 (669,990 parasites in 359 counts). Thus, the average number of parasites per count in the first-named strain was 2·5 times as great as in the last-named. This points to a higher antigenicity of the latter strain, as compared with the former.

The authors also compared the gametocyte productivity and the infection rate in mosquitoes fed on patients infected with the two strains of malaria. The mean number of gametocytes per 500 leucocytes was 8·9 (3♂, 5·9♀) in the case of the "Northern" strain, and 14·5 (6·7♂, 7·8♀) in the case of the "Southern" one. The number of sexual forms produced by the latter thus being 1·5 times as great as that by the former.

A total of 959 mosquitoes were fed on patients, 62 of whom were infected with the "Southern" strain and 47 with the "Northern" one. In the former case 46·7 per cent. of the mosquitoes became infected, in the latter 19·1 per cent.,

the results thus corresponding to the number of gametocytes present in these strains. The two strains also differed with regard to their response to treatment with quinine, the " Northern " strain being more resistant than the " Southern " one, but there was no difference in their reaction to acriquine [mepacrine].

*C. A. Hoare.*

Bennison, B. E. & Coatney, G. R. **Inactivation of Malarial Parasites by X-Rays.** *Pub. Health Rep.* Wash. 1945, Feb. 2, v. 60, No. 5, 127–32. [10 refs.]

Working with suspensions of sporozoites of *Plasmodium gallinaceum* in a mixture of equal parts of chick serum and physiological saline and with suspensions of infected red blood corpuscles in citrate-saline solution, the authors have tested the effect on the infectivity of such suspensions of exposure to X-ray irradiation of varying intensity. The sporozoites were inactivated by 8,000 roentgens, as proved by failure to produce infection on intramuscular injection. In the case of the trophozoites the suspension, which was of such a strength that 0·1 cc. contained 16,000,000 parasitized red blood corpuscles, was inactivated by 20,000 roentgens, as proved by intravenous inoculation of 0·1 cc. amounts. Less than 10,000 roentgens altered the parasites in such a manner that after inoculation the prepatent periods and survival times were increased. Attempts to increase the survival time of infected chicks by exposing them to radiation were not successful. In one experiment it was shown that the exposure of human blood infected with *P. malariae* to 5,000 roentgens rendered it non-infective, as proved by injection into a patient with central nervous system syphilis.

*C. M. Wenyon.*

Covell, G. **Notes on the Distribution, Breeding Places, Adult Habits and Relation to Malaria of the Anopheline Mosquitoes of India and the Far East.** *J. Malaria Inst. of India.* 1944, Dec., v. 5, No. 4, 399–434, 1 folding map. [Numerous refs.]

The title of this paper describes its scope. Only those species of anopheline mosquitoes are dealt with which either have been found naturally infected with malaria or have been suspected on epidemiological grounds to transmit the disease. The area surveyed includes India, countries of the continent of Asia south of and including South China, and the islands from Formosa in the north to Australia in the south, from the Andamans and Nicobars in the west to the New Hebrides and New Caledonia in the east. More than 100 species of *Anopheles* have been described from these regions, of which only 41 have been proved or suspected to be vectors of malaria ; only these 41 species are referred to. Two groups of species have been of great importance during the war—the *fluviatilis-minimus* group, which is responsible for intense malaria in the foothills of north India, and in Burma and South China ; and *A. punctulatus*, with its variety *moluccensis*, which are responsible for intense malaria in New Guinea and the S.-W. Pacific Islands.

There are 12 important malaria vectors : *A. culicifacies, A. fluviatilis, A. maculatus, A. minimus, A. minimus* var. *flavirostris, A. philippinensis, A. punctulatus, A. punctulatus* var. *moluccensis, A. stephensi, A. sundaicus, A. superpictus, A. umbrosus.*

Sixteen species are of local importance as vectors in certain areas. These are : *A. aconitus, A. annularis, A. bancrofti, A. barbirostris, A. hyrcanus* var. *nigerrimus, A. hyrcanus* var. *sinensis, A. hyrcanus X, A. jeyporiensis* var. *candidiensis, A. kochi, A. leucosphyrus, A. novumbrosus, A. pattoni, A. stephensi* var. *mysorensis, A. subpictus* var. *indefinitus, A. tessellatus, A. varuna.*

The remaining 13 species have probably no practical importance ; they are : *A. amictus, A. annulipes, A. baezai, A. jeyporiensis, A. karwari, A. mangyanus, A. pallidus, A. pulcherrimus, A. ramsayi, A. separatus, A. splendidus, A. subpictus, A. vagus.*

All available information regarding the distribution and habits of each of these species is admirably condensed, but there are gaps in our knowledge. Some species include two or more biological races, morphologically indistinguishable but with very different habits : such problems call for thorough investigation.

In the bibliography attached to the paper there are 239 references.

*Norman White.*

SIDDONS, L. B. **The Experimental Transmission of Quartan Malaria by *Anopheles culicifacies* Giles.** *J. Malaria Inst. of India.* 1944, June, v. 5, No. 3, 361–73, 2 charts. [24 refs.]

The *A. culicifacies* used in these experiments were bred from full-grown larvae or pupae collected in the field. Thick blood films from the gametocyte carriers were always examined to exclude any with mixed infections. The experiments described were all carried out in favourable conditions of temperature, 70° and 80°F., and of relative humidity, 100 and 90 per cent. Except for the single feed on a gametocyte carrier the mosquitoes subsisted on raisins and water.

Successful infection of *A. culicifacies* with *P. malariae* was obtained in the case of six lots of mosquitoes fed on five different gametocyte carriers. The gland infection rate of these lots was 34·4 per cent. and the mid-gut infection rate 6·9 per cent. All three specimens of one lot examined had gland infection. The number of gametocytes in the carriers in these positive experiments varied from 295 to 650 per cmm.

No infection was obtained in the case of 17 lots of *A. culicifacies* fed on six gametocyte carriers. If all the experiments be grouped together the infection rate of mosquitoes was 9·4 per cent., gland infections 6·5, and gut infections 4·9 per cent.

The positive lots were fed between August and February, four of the six in the cold weather months January and February. Fifteen of the 17 negative lots were fed in the hot weather and early monsoon months March to July. It is concluded that the infectivity of the gametocytes of *P. malariae* varies seasonally. In about half of the negative experiments the gametocyte density was probably too low. At 70°F. the extrinsic incubation period was 19 days in one lot and 22 days in another. At 80°F. the minimum extrinsic incubation period was 14 days. The sporozoites of *P. malariae*, in freshly dissected preparations in saline solution under a coverslip, measured about 13 microns, as compared with 11·7 microns for *P. vivax* and *P. falciparum*.

A man in good health whose blood was negative for malaria parasites in thick and thin films was bitten by 12 *A. culicifacies*. The mosquitoes were dissected immediately after they had fed on him ; four of the mosquitoes had moderate gland infection. The man developed quartan malaria. Parasites were first noted in the blood 30 days after the infecting bite. The first attack of fever occurred 36 days after infection. The patient experienced nine paroxysms at quartan intervals ; he was then treated with quinine. There was a recurrence two months later.

Details are given regarding the periodicity, rate of segmentation and gametocyte production in the untreated infection. *Norman White.*

SIDDONS, L. B. **Observations on the Influence of Atmospheric Temperature and Humidity on the Infectivity of *Anopheles culicifacies* Giles.** *J. Malaria Inst. of India.* 1944, June, v. 5, No. 3, 375–88. [27 refs.]

This is an account of observations made in Calcutta on the influence of atmospheric temperature and humidity on the infectivity of *A. culicifacies*. Ordinary biological incubators and an air-conditioned " cool room " were used. The *A. culicifacies* were bred from full-grown larvae or pupae collected in the field ; attempts at colonizing this species were unsuccessful.

Lowering of the temperature within the range 94° to 70°F. increases the period of survival of *A. culicifacies*, especially if the decrease be combined with increased relative humidity. Mean temperatures below 60°F. and humidities below 60 per cent. are inimical to this species. Indian strains of *P. vivax* and *P. falciparum* do not develop in *A. culicifacies* at temperatures above 94°F. The optimum range of temperature for development in the mosquito and for transmission is from 70° to 86°F. provided humidity is sufficient for the survival of *A. culicifacies*. The lower limiting temperatures for the development of parasites in this species were not determined : oöcysts of *P. falciparum* and of *P. vivax* have been found at a mean temperature of 59·6°F. but *P. malariae* did not develop at all in these conditions. The extrinsic incubation period of the parasites varied from seven days for *P. vivax* at 86°F. and 19 days for *P. malariae* at 70°F. *Norman White.*

VISWANATHAN, D. K., RAO, T. R. & RAO, T. S. R. **The Behaviour of *Anopheles fluviatilis*. Part II. Nocturnal Movements and Daytime Resting Places and their bearing on Spray-Killing.** *J. Malaria Inst. of India.* 1944, Dec., v. 5, No. 4, 449–61.

An examination of mosquitoes captured in dwelling houses in the North Kanara District, in the extreme south of the Bombay Presidency, indicated that about 60 per cent. of female *A. fluviatilis* leave the house for some outside resting place every night during the months of September to November, when the gonotrophic cycle [the period during which a blood meal is digested and the eggs mature] takes 48 hours in the laboratory. From December to February 40 per cent. behave in this fashion ; the duration of the gonotrophic cycle is then 72 hours. Direct experiment confirmed this finding ; most freshly-fed *A. fluviatilis* left their places of feeding between the time of feeding and dawn. These observations have an obvious bearing on the use and limitation of spray-killing as a malaria control measure where this species is the vector. The authors recommend that in sparsely populated areas in North Kanara, daily spraying should be used. In larger centres of population, where some larval control is possible, spray-killing twice a week is recommended during that part of the transmission season when the duration of the gonotrophic cycle is 72 hours. When the duration of the cycle is 48 hours, spraying should be carried out on two consecutive days with intervals of two days without spraying.

Some 71 per cent. of *A. fluviatilis* which enter dwellings do so during the first quarter of the dark hours, 19 per cent. during the second quarter, 7 per cent. in the third quarter, and 3 per cent. in the last quarter. *Norman White.*

IYENGAR, M. O. T. **Problems relating to Malaria Control in Deltaic Bengal.** *J. Malaria Inst. of India.* 1944, Dec., v. 5, No. 4, 435–47.

*A. philippinensis* is the only important vector of malaria in the deltaic region of Bengal, excluding the estuarine zone. There is a significant positive correlation between the prevalence of this species and malaria endemicity. No other species, except for occasional single observations, has been found naturally

infected. *A. philippinensis* is relatively infrequent during the first half of the year and sporozoite infections are then rare. The period of maximum transmission is from September to November.

Human dwellings are the favoured daytime resting places of *A. philippinensis*; it is infrequently found in cattle-sheds. It generally rests on the wall very close to the floor. The main breeding season of this species is the rainy season, July to October; ponds with clean water, free from organic pollution, are the favoured breeding places. Submerged aquatic vegetation, reaching the surface as subaquatic bushes, favours breeding, whilst any shade-producing plant is inhibitory. A dense growth of the water hyacinth, *Eichornia speciosa*, effectively controls the breeding of *A. philippinensis*. Areas in Deltaic Bengal with a high water table have a low prevalence of *A. philippinensis*; drainage as an anti-malaria measure is therefore contraindicated and wet cultivation should be encouraged. This species does not ordinarily breed in ricefields.

The control of *A. philippinensis* should include the insecticidal spraying of dwelling rooms; the control of breeding in ponds by complete removal of all forms of aquatic vegetation or by stocking them with water hyacinth so as to form a complete cover; raising the water table by irrigation or other method.

*Norman White.*

Hess, A. D. & Hall, T. F. **The Relation of Plants to Malaria Control on Impounded Waters with a suggested Classification.** *J. National Malaria Soc.* Tallahassee, Fla. 1945, Mar., v. 4, No. 1, 20–46, 2 figs. [23 refs.]

*Anopheles quadrimaculatus*, the only important malaria vector in the South-eastern United States, breeds solely in waters on which there is an abundance of vegetation or floatage intersecting the water surface: "a clean water surface does not produce quads." This fact explains the extensive work that has been carried out by the Health Department of the Tennessee Valley Authority on the relation of plants to malaria control on impounded waters [see this *Bulletin*, 1945, v. 42, 182].

This paper contains a classification of plants in relation to malaria control. All plants of importance to malaria control in the Tennessee Valley are placed in ten basic types, each having well-defined relationships to the biology and control of *A. quadrimaculatus* in impounded waters. The large mass of information does not lend itself to adequate summary in small space. Though the results of the painstaking investigations are of local rather than general interest and importance the methods employed will interest a large number of malariologists in distant fields who have cognate problems to solve. They should consult the original paper.

*Norman White.*

Schoof, H. F., Schell, S. C. & Ashton, D. F. **Survival of Anopheline Larvae and Pupae in Muck.** *J. Econom. Entom.* 1945, Feb., v. 38, No. 1, 113–14.

In N. Carolina, on several occasions, high adult anopheline counts could not adequately be explained by the data on collections of larvae. It occurred to the authors that larvae and pupae may be able to persist in mud, and that if so they might live in certain creeks which were from time to time filled by wind tides, which are not subject to regular periodicity. Mud was therefore placed in a bucket and water added; larvae and pupae (*Anopheles quadrimaculatus* and *A. punctipennis*) was placed in the water, which was then carefully removed until the surface was reduced to the consistency of thick mud. After 29 hours in this mud most of the larvae and all the 4 pupae were alive; after 48 hours only a few of the larvae survived, but 4 of 4 pupae were still alive. From some of these adults developed.

Examination of a dry ditch with a slimy bottom, into which waste water from a house was run, showed that 3rd and 4th stage larvae, and some culicine pupae, appeared ; they must have been present in the mud, but for how long is not stated.

This work evidently needs to be amplified, and the fact that larvae and pupae can survive for some time in mud [the authors use the rollicking word muck] must have a bearing on anti-larval methods of anopheline control.

*Charles Wilcocks.*

Barnes, R. C. *Anopheles walkeri* **in Diurnal Shelters in Massachusetts.** *J. Econom. Entom.* 1945, Feb., v. 38, No. 1, 114.

Eyles, D. E. & Burgess, R. W. *Anopheles walkeri* **in South Carolina.** *J. Econom. Entom.* 1945, Feb., v. 38, No. 1, 115.

McClure, R. D. & Lam, C. R. **Malaria from Bank Blood Transfusions.** *Surgery, Gynecol. & Obstet.* 1945, Mar., v. 80, No. 3, 261–2.

Comparatively few instances of the transmission of malaria by blood transfusion have been reported: Wright (*J. Pediat.*, S. Louis, 1938, v. 12, 327) collected 23 cases from the literature and added six of his own ; Gordon [this *Bulletin*, 1942, v. 39, 252] described the first recorded case of transmission by stored blood and added five more references (McCulloch, *Canadian Med. Ass. J.*, 1937, v. 37, 26 ; Gardner and Dexter, this *Bulletin*, 1939, v. 36, 783 ; Zussman and Silver, *Med. Rec.*, 1938, v. 148, 176 ; Nabarro and Edward, this *Bulletin*, 1940, v. 37, 362 ; and Chamorro and Molezzun, *Semana Med.*, 1938, v. 2, 908). [For other records see this *Bulletin*, 1940, v. 37, 456 ; 1941, v. 38, 505 ; 1944, v. 41, 8 and 92 ; and 1945, v. 42, 174.]

In the present paper, the authors report two cases of transmission with blood which had been refrigerated for five days. In each case the donor was an Italian man, born in Sicily, who had lived for over 30 years in the United States of America. These two donors were uncles of a youth whose blood bank debt they were paying by becoming blood donors. In both cases quartan malaria parasites were transmitted.

The first patient, a woman of 57 years, was given 600 cc. of citrated blood during an operation. Her temperature rose to 101°F. on the following day, remained normal until the 32nd day when it rose to 101°F., and rose again on the 35th day to 100·6°F., but no chills were recorded. She was discharged from hospital, but was readmitted two weeks afterwards, complaining of having had attacks of nausea and vomiting preceded by rigors. On admission, her blood showed : erythrocytes, 3,100,000 per cmm. ; leucocytes, 2,350 per cmm. with 67 per cent. of polymorphonuclears. Examination by X-rays indicated splenic enlargement but this was ignored. On the following day her temperature rose to 105°F. and next day quartan malaria parasites were found in her blood. Treatment with quinine was effective.

The second patient, a woman aged 23, received 500 cc. of citrated blood during an operation, and remained afebrile from the 3rd to the 22nd day, when she was given another blood transfusion—this time with the blood of a professional donor who had never been in a malarious country and had often given blood without mishap. Her temperature rose at once to 101·6°F. but was normal next day and she was discharged on the 23rd day after the operation with instructions to record her temperature. Three days later, her temperature was 102·6°F., and a fortnight after this she reported that chills and fever occurred every third day ; blood smears were negative. Her temperature remained

normal for a further 19 days when it rose to 104°F., and every third day she had rigors which began between 4 and 6 p.m. and lasted for about five hours. Quartan malaria parasites were found in her blood, and her spleen was palpable. Treatment with quinine was successful. [In his abstract of GORDON'S paper, MOLLISON comments that the possibility of the Italian donors having been reinfected in the U.S.A. was not discussed ; it is also not discussed in the present paper, but the donors gave a history of having had good health and no fever.]

*J. F. Corson.*

KASSIRSKY, I. A. **[Pernicious Malaria and its Treatment.]** *Klinicheskaia Meditsina* [=*Clinical Medicine*]. Moscow. 1944, v. 22, No. 9, 19–28. [In Russian.]

The author draws attention to an increase in the incidence of pernicious forms of malaria in the Soviet Union. This is due to war conditions, as the result of which anti-malarial measures were temporarily suspended or disorganized. The main varieties of malignant tertian malaria dealt with are the typhoid, bilious, blackwater, adynamic, algid, cerebral and comatose forms. To these is added a fulminating type of *vivax* malaria. A description is given of the symptoms and pathology of these conditions. In such cases specific treatment is given immediately on admission by parenteral injection of acriquine [mepacrine] or quinine. In the case of acriquine the dose is 0·45–0·5 gm., repeated next day, and followed during the next 3–4 days by doses of 0·4–0·45 gm., the daily dose being divided into two portions. In the case of quinine the daily dose is up to 1·5–2 gm. (in two portions) and the course lasts 5–7 days. In very severe and neglected cases acriquine or quinine is injected intravenously. In addition to specific treatment the general condition of the patients suffering from pernicious malaria should be maintained by symptomatic therapy.

*C. A. Hoare.*

HUGHES, K. T. & NIESCHE, F. W. **Spontaneous Rupture of Malarious Spleen followed by Left Subphrenic Abscess with Recovery.** *Med. J. Australia.* 1945, Mar. 24, v. 1, No. 12, 300–302, 1 fig.

EHRMAN, F. C., ELLIS, J. M. & YOUNG, M. D. *Plasmodium vivax* **Chesson Strain.** *Science.* 1945, Apr. 13, 377.

A note to the effect that the strain of *Plasmodium vivax* from a patient infected in New Guinea, and now being experimentally transmitted in the United States through *Anopheles quadrimaculatus*, is reacting to certain drugs differently from the standard strain (St. Elizabeth) which has largely been used for drug testing. The new strain is known as the Chesson strain.

*Charles Wilcocks.*

SIEGEL, H., MUSHETT, C. W. & EMERSON, Gladys A. **Influence of Protein and Thiamine Intake on Pathologic and Weight Changes produced by Atabrine.** *Proc. Soc. Exper. Biol. & Med.* 1945, Feb., v. 58, No. 2, 157–9, 1 fig. [11 refs.]

Groups of 20 rats were used and placed on high protein (30 per cent. casein) or low protein (6 per cent. casein) diets respectively. In certain of these groups the rats were given mepacrine (atabrine) 4·5 mgm. per kgm. by mouth daily for 41 days ; this is 5 per cent. of the LD 50. The hepatic damage resulting from the mepacrine was greater (95 per cent. of livers affected with necrosis, which

was usually severe) in the low protein group than it was in the high protein group (44 per cent. of livers affected with necrosis, which was usually slight). On the other hand the incidence and degree of myocardial damage was slightly greater in the rats fed on the high protein diet. In other experiments, it was found that thiamin deficiency had no effect upon the hepatic and myocardial damage produced by mepacrine. The daily administration of mepacrine to rats maintained on high and low protein rations resulted in a retardation of growth beyond that observed in their isocaloric controls which did not receive mepacrine. [It must be remembered that these rats were given very large doses of mepacrine specially in order to produce visceral lesions ; extensive researches have failed to reveal any visceral lesions when 0·1 gm. mepacrine is taken daily by men.] *F. Hawking.*

GASKILL, H. S. & FITZ-HUGH, T., Jr. **Toxic Psychoses following Atabrine.** *Bull. U.S. Army Med. Dept.* 1945, Mar., No. 86, 63–9.

During seven months 35 individuals out of 7,604 " cases of malaria " admitted into an Army hospital in a highly endemic area where they were treated with mepacrine, developed toxic psychoses, 0·4 per cent. During the same period 197 acute psychoses not related either to malaria or mepacrine were treated in the hospital ; this represents 3 per cent. of the total admissions to hospital excluding admissions for malaria.

The patients were of two groups : Group A, American soldiers, whites and negroes in about equal proportions ; Group B, soldiers of an allied nation. Most of Group A had malaria for the first time ; most of Group B had had one or more attacks of malaria in the past. Of the 35 patients with post-mepacrine psychoses three were white and three Negro Americans, and 29 allied soldiers.

The treatment was in accordance with the S.G.O. Circular Letter No. 135, 1942 [see this *Bulletin*, 1944, v. 41, 96], the total amount of mepacrine administered being 2·1 gm. The time of onset of the psychosis varied, the most rapid being on the third day of treatment, after 0·9 gm. of mepacrine had been taken. The latest date of onset was twelve days after the completion of treatment. The most common date was six days after the completion of treatment. The onset of the psychosis was often insidious.

In some cases there was a sudden increase in motor and psychomotor activity, with auditory and visual hallucinations and delusions. Occasionally there was disorientation. The effect was usually one of euphoria and expansiveness. In cases with insidious onset there was gradual clouding of the sensorium, disorientation and " loss of recent memory " ; and diminished activity in the intellectual and motor spheres. The patients were withdrawn and seclusive, the effect being one of bewilderment and fearfulness.

Infection with *P. falciparum* was twice as frequent as infection with *P. vivax* and this proportion held good for the patients who developed toxic psychoses.

Thirty-three of the 35 patients recovered, one in eight days, one in 85 days, the average duration of psychosis being 23 days. In the two patients who failed to recover it seems that a schizophrenic reaction had been precipitated. Complications occurred in three patients who recovered :—dislocation of the shoulder, cystitis from repeated catheterization, and spontaneous rupture of the spleen.

It is of great interest to note that 16 of these patients who had recovered from their toxic psychoses were re-treated with mepacrine, 15 without any manifestation of untoward symptoms, the other becoming only mildly excited for 24 hours on the last day of treatment. The hypothesis of temporary desensitization to mepacrine as a result of an acute attack is compatible with the observations, but this is entirely speculative. Vitamin deficiency as a contributory cause

of the psychoses is a possibility. There was no evidence that the patients who developed post-malaria-mepacrine psychoses were psychiatrically unstable [except, of course, as a result of taking mepacrine]. *Norman White.*

RUSSELL, H. K. **Eosinophilia caused by Atabrine.** *U.S. Nav. Med. Bull.* 1945, Mar., v. 44, No. 3, 574–5.

A study was made of the eosinophil count in men taking mepacrine (atabrine) in the tropics. A careful examination of the stools was made to detect hookworm ova, and only men who were free from them were accepted. Of 119 patients on mepacrine therapy for malaria, and who had been in the tropics for an average period of 14 months, 90 (75 per cent.) showed an eosinophilia of 6 per cent. or over; the highest was 27 per cent. The average for the 119 men was 8·4 per cent. Among 50 men on suppressive mepacrine whose skin was stained yellow by the drug, and who had been in the tropics for an average period of 10 months, 36 (70 per cent.) showed an eosinophilia of 6 per cent. or more; the maximum was 22 per cent. The average for the whole group was 7·2 per cent. Among 33 men who had never taken mepacrine and who had been in the tropics for an average period of eight months, two had eosinophil counts of 6 and 7 per cent. respectively. The average for the whole group was 3 per cent. Bone marrow aspiration biopsies in 15 cases showed marked hyperplasia of the eosinophilic cells. It is believed that this is due to the mepacrine. *F. Hawking.*

JANG, C. S. **Present Status of Studies on Chinese Antimalarial Drugs.** *Chinese Med. J.* Washington, D.C. 1944, Apr.–June, v. 62, No. 2, 185–92.

"Scientific studies on the Chinese antimalarial herbs have been surveyed. While the antimalarial value of Sinine (from *Fraxinus mallacophyla*) requires further investigation, the clinical experiments with Anobin (probably from *Bupleureum falacatum*) and Fraxin (from *Fraxinus chinensis*) have not been able to demonstrate any antimalarial effect. Ch'ang Shan (*Dichroa febrifuga*) appears to be most promising as an antimalarial remedy, the clinical results being quite comparable with those of quinine. Two alkaloids have been isolated from Ch'ang Shan, and their chemotherapeutic studies are in progress."

FAIRLEY, N. H. **Chemotherapeutic Suppression and Prophylaxis in Malaria. An Experimental Investigation undertaken by Medical Research Teams in Australia.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1945, May, v. 38, No. 5, 311–55, 4 graphs. Discussion 355–65 (JAMES, S. P.; SHUTE, P. G.; HODGE, E. H. V.; MACDONALD, G.; REID, J.; FINLAY, G. M.; MAEGRAITH, B.; SINTON, J. A.; ROGERS, L.; and FAIRLEY, N. H. (in reply)).

The high incidence and gravity of malaria among troops in the South-Western Pacific Area prompted the establishment of two research groups in tropical Queensland, under the direction of the author, to investigate the mode of action and the precise value of anti-malarial drugs—including certain new sulphonamides, mepacrine and quinine—as suppressants and true causal prophylactics, in volunteers infected with Papuan strains of both *P. vivax* and *P. falciparum*. Volunteers taking anti-malarial drugs in a specified daily dosage were exposed to bites of malaria-infected mosquitoes, and were studied throughout the incubation period of malaria. They were then sent inland to another Australian General Hospital, where the second group of research workers continued investigations to determine whether the drug in question had merely suppressed the infection or cured the patient.

For this experimental transmission of malaria *A. punctulatus* var. *typicus* was mainly used. It survived better under laboratory conditions, and was a more efficient all-round transmitter than either *A. punctulatus* var. *moluccensis* or *A. annulipes* ; it had a high average infection rate. The larvae were collected in New Guinea and flown to Queensland, some 20,000 a week.

Volunteers were restricted to men who had never lived in malarious areas, and who were organically sound, physically fit and mentally stable. The experiments were carried out on a very large scale but no evidence of insusceptibility or natural immunity to these New Guinea strains of *P. vivax* and *P. falciparum* was ever demonstrated. It would seem that no European who has not previously been exposed to malaria is ever refractory to infection if viable sporozoites or trophozoites of *P. vivax* or *P. falciparum* be inoculated in a reasonable dosage.

It is not possible to give an adequate summary of the large mass of information contained in this important contribution. The main conclusions are : —

Quinine sulphate given in solution, 10 grains daily, commencing two days before the first infective bite, failed to prevent overt attacks of *falciparum* malaria. Similar doses completely suppressed *vivax* attacks in some cases but not in all.

Certain sulphonamides (sulphadiazine, sulphamerazine and sulphamezathine) in doses of 1·0 gm. daily, suppressed *falciparum* malaria in 20 out of 21 volunteers, and cured 17 of the 21. These drugs are not causal prophylactics ; they destroy the asexual blood parasites. They failed to suppress *vivax* infections ; 21 of 24 volunteers had clinical attacks while taking 1·0 gm. a day. The remaining three developed attacks shortly after the end of treatment.

Mepacrine, 0·1 gm. daily, suppresses *falciparum* malaria, and if continued for the requisite period after the last exposure to infection, cures the disease. In these experiments the drug was continued for 23 days after the last bite when exposure to infective bites did not exceed seven days. Subinoculation tests proved the action of mepacrine to be on the asexual blood parasites. Mepacrine in these doses also suppresses *vivax* malaria, but clinical attacks regularly occur a few weeks after the cessation of treatment. Hard physical work, and exposure of the subjects to arduous conditions comparable to those experienced on active service, did not rob mepacrine of its efficacy.

The experiments have shown that a correct mepacrine regimen may secure the control of malaria in hyperendemic areas. This knowledge has been applied with dramatic results. In December 1943, the malaria rate in Australian troops in New Guinea was 740 per 1,000 per annum ; in November 1944, this rate had fallen to 26. Other causes have been at work : there was less fighting in 1944, and antimosquito measures were more effective, but the absence of frequent *vivax* relapses indicated a high standard of mepacrine discipline.

The problem of *vivax* relapses after the cessation of mepacrine treatment remains. Malaria due to the New Guinea strain of *P. vivax* is characterized by the following features : (1) relapses appear within a few weeks of the primary fever or cessation of treatment ; (2) though febrile attacks are readily controlled by drugs, the subsequent relapse rate is very high. The experiments indicate that the tissue forms of *P. vivax* are very persistent, whereas the tissue cycle of *P. falciparum* seems to be of short duration.

Subinoculations by direct blood transfusions of not less than 200 cc. of blood were frequently used to determine the infectivity of blood. Seven minutes after biting has ceased on one arm, blood from the other arm has produced malaria in the recipient in both *falciparum* and *vivax* infections, showing that sporozoites were circulating. No such positive results were obtained 30 minutes after biting ; the sporozoites are rapidly removed by macrophages and fixed tissue endothelial cells. Thereafter, for several days, negative results only were obtained. In *P. falciparum* infections, subinoculations from the seventh day

onwards, but not before, transmitted malaria; in *P. vivax* infections sub-inoculations were invariably negative till the ninth day; thereafter positive results were obtained. *Norman White.*

MINGOJA, O. Medicamentos quimioterápicos antimaláricos. [**Anti-Malarial Drugs.**] "*Selecta Chimica.*" São Paulo. 1944, Dec., No. 1, 5–120, 7 figs. [Numerous refs.]

This is a review of the literature on the subject; it deals with quinine and other cinchona derivatives; plasmoquine and other substances of the quinoline series; mepacrine; and with other synthetic preparations. There is a good deal of chemical information, and the structural formulae of a large number of drugs are presented. This article will be very useful as a work of reference for those who read Portuguese. *Charles Wilcocks.*

RICE, P. L., HUFFAKER, C. B. & BACK, R. C. **DDT-Thanite Sprays for Mosquitoes.** *Soap.* New York, 1945, Mar., v. 21, No. 3, 119, 121 & 146, 2 figs.

Investigations which were started as a result of the shortage of pyrethrins have led to the development of sprays containing a mixture of 2, 2 bis (parachlorphenyl) 1, 1, 1 trichlorethane (DDT) and Thanite (a terpene thiocyano ester). In laboratory tests the standard Peet-Grady testing chamber was employed with six ml. of insecticide and a two and a half minute exposure. The test insect was *Anopheles quadrimaculatus*. Field tests were also carried out in a cattle shed, open on one side. The insecticide was sprayed about three to four feet away from the wall on which the cages were suspended, 6·5 ml. of spray being discharged over 48 sq. ft. of surface.

In the Peet-Grady test it was found that a 1 per cent. solution of DDT gave a 57 per cent. knock-down after two and a half minutes and a 100 per cent. kill 24 hours later. With a solution containing 0·2 per cent. DDT and 0·80 per cent. Thanite the knock-down was 92 per cent. and the kill 96 per cent., while 0·4 per cent. DDT and 0·6 per cent. Thanite gave 86 per cent. knock-down and 99 per cent. kill. In comparison a spray of 0·02 per cent. pyrethrins gave a knock-down of 97 per cent. and a kill of 94 per cent. The advantage of adding "Thanite" is that it increases the rate of knock-down, but the DDT is mainly responsible for the lethal action of the spray.

In the field tests the authors used one and one-half times the concentration of toxic ingredients employed in the laboratory tests, and the mixed sprays again gave satisfactory knock-downs and kills. A spray of pyrethrins, also of one and a half times the concentration used in the Peet-Grady test, gave approximately the same knock-down as the mixed sprays, while the 24 hour percentage kill was about 20 per cent. less. *W. A. L. David.*

KANCHAVELI, G. I. [**Employment of Emulsions of Mineral Oils for the Control of Anopheles Larvae.**] *Med. Parasit. & Parasitic Dis.* Moscow. 1944, v. 13, No. 4, 93–5. [In Russian.]

An account is given of the larvicidal effect of various mineral substances tested as substitutes for Paris green and petroleum, the use of which had to be restricted owing to war conditions. Promising results were obtained with kerosene, green oil and a preparation known as "flycide." These were emulsified with delphinium (or green) soap in the following proportions: 1 part soap+0·5

water+5 to 10 parts larvicide. The mixture was sprayed over natural water collections, in which *Anopheles* larvae were present, in doses of 0·3–0·5 gm. per 1 sq. metre of the surface, the higher dose thus containing 0·04 gm. of soap and 0·43 gm. of larvicide. This treatment resulted in the destruction of 100 per cent. of the larvae, starting 2–3 hours after application, the oily film of the larvicide remaining on the surface of the water up to 72 hours at 19·5–27·5°C. These emulsions have no harmful effect upon the remaining fauna and flora of the water, their only drawback being the rapid evaporation of the larvicide.

*C. A. Hoare.*

Mulrennan, J. A., Goodwin, M. & Shannon, R. C. **The Importation of Exotic Anophelines into the United States.** *J. National Malaria Soc.* Tallahassee, Fla. 1945, Mar., v. 4, No. 1, 56–8.

In August 1943, a dead *Anopheles* (*Nyssorhynchus*) in a spider web was found under a concrete bridge a mile from the runway on the Morrison Field air base West Palm Beach. In May 1944, a single fourth instar *A. albimanus* larva was found in a canal running through the Boca Raton Army Air Field. There was presumptive evidence that a female *A. albimanus* came in by plane from Porto Rico and oviposited at Boca Raton. These are the first records of *A. albimanus* having been collected in Florida since 1904, when it was imported into Key West from Vera Cruz. During the first nine months of 1944, 36 anophelines, all dead, were collected during quarantine inspections of airplanes at Miami, Florida. They included *A. crucians*, *A. grabhamii*, *A. walkeri*, *A. albimanus*, *A. pharoensis* and *A.* (*Nyssorhynchus*) species. It would appear that without constant vigilance foreign species of anophelines might enter and become established in the United States. It is important that aircraft should be effectively treated with insecticide at the port of departure and the process repeated at the port of entry. *Norman White.*

See also below p. 656, Fairley, **Medicine in Jungle Warfare.**

Cantrell, W. & Jordan, Helen B. **New Mosquito Hosts for** *Plasmodium gallinaceum.* *J. Parasitology.* 1945, Feb., v. 31, No. 1, 55–6.

Nine species of mosquito, wild or laboratory bred, were allowed to feed on chickens infected with *Plasmodium gallinaceum*, and were dissected from 3 to 9 days later and examined for the presence of oöcysts ; a few were examined for sporozoites and oöcysts after 9 to 21 days. Seven of the species had not previously been studied in this respect ; they were *Aëdes campestris*, *A. stimulans*, *A. biseriatus*, *A. trivittatus*, *Culex salinarius*, *Mansonia perturbans*, and *Theobaldia inornata*.

Oöcysts were found in all the species, in varying numbers, but this variation was not necessarily related to susceptibility as different chickens were used in the experiment.

All species of *Aëdes* so far tested have been found susceptible.

No infection was found among 120 *Culex pipiens* which were also fed, thus confirming Brumpt's conclusion (*Ann. Parasit. Hum. et. Comp.*, 1936, v. 14, 597) that this species is resistant. *J. F. Corson.*

## BLACKWATER FEVER.

FOY, H., KONDI, Athena, REBELO, A. & SOEIRO, A. **Survival of Transfused Red Cells in Blackwater Fever Circulation and of Blackwater Red Cells in Normal Circulation. (Preliminary Report).** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1945, Mar., v. 38, No. 4, 271–86, 3 charts. [19 refs.]

The authors transfused blood group A cases of blackwater fever with compatible group O blood, and " a normal healthy person " with blood cells from a group O case of blackwater fever. The survival time of the transfused cells was estimated by the method of differential agglutination (ASHBY, *J. Exper. Med.*, 1919, v. 29, 267).

They also transfused serum from a blackwater fever case into a patient suffering from an acute attack of subtertian malaria.

Making due allowance for the limitations of the methods used and the restricted material available, the authors obtained the following results :—

(1) Transfused cells are destroyed in blackwater fever haemolysis as readily as the patient's own cells.

(2) The survival time of normal red cells transfused into cases of blackwater fever nine days after haemolysis had stopped was 30–35 days ; after 18 months the survival time was normal.

(3) Cells taken from a haemolysing blackwater fever case and transfused into a normal group A recipient had a survival time of only six days.

A single experiment, in which cells from a blackwater fever group O patient were taken in a quiescent period 10 days after haemolysis and injected into a normal A group recipient, was inconclusive as the donor developed further haemoglobinuria five days after the blood had been withdrawn. The survival time of these cells was shorter than normal.

(4) Plasma from a blackwater fever case, " laden with oxyhaemoglobin and methaemoglobin," transfused into a patient with acute malaria had no haemolytic effect.

This paper is interesting and stimulating. There is a brief discussion of the various theories of the nature of haemolysis in blackwater fever, and haemolysis in this disease is compared with that in haemolytic jaundice (DACIE and MOLLISON, *Lancet*, 1943, May 1, 550).

The authors conclude from their results that " in blackwater fever, at least, the fundamental factor is extra-cellular and can haemolyze normal cells in the blackwater fever circulation, as well as bring about changes in the blackwater fever red cells that render them susceptible to destruction even in normal circulations. Thus the situation in haemolytic jaundice and blackwater fever would appear to differ in that whatever brings about the lysis of the red cells in haemolytic jaundice is not capable of affecting normal red cells transfused into patients with active haemolytic jaundice."

[The discussion would have been more effective if the authors had had access to the work of BROWN *et al.* [*Bulletin of War Medicine*, 1944, Dec., v. 5, No. 4, 250] who investigated the fate of transfused cells in a wide variety of anaemic conditions and to that of PONDER (*J. Gen. Phys.*, 1944, v. 27, 283) regarding haemolysis by normal tissue.] *B. G. Maegraith.*

## LEISHMANIASIS.

BURCHENAL, J. H. & WOODS, R. P. **Visceral Leishmaniasis : Report of Three Cases of its Occurrence in Members of the Armed Forces of the United States.** *War Medicine.* Chicago. 1945, Mar., v. 7, No. 3, 173–7, 1 chart.

The paper describes three cases of leishmaniasis in men of the U.S. Army who had served in N. Africa and Sicily. Two of these were typical cases of kala azar, in each of which there was some difficulty in discovering leishmania. However, in both parasites were eventually found, in the first case at the third sternal puncture, and in the second at spleen puncture after two unsuccessful sternal punctures. In both cases treatment with diamidinostilbene was tried without success, reliance being finally placed on sodium antimony gluconate. In various courses, the first patient had 282 cc. intravenously (representing 5,640 mgm. of antimony) and the second 252 cc., representing 5,040 mgm. of antimony). It is of interest to note that during the antimony therapy both patients suffered relapses of benign tertian malaria, which had to be controlled by quinacrine [mepacrine] hydrochloride.

The third case is of particular interest, in that the only symptom complained of by the patient was a visible swelling of the post-cervical and post-auricular lymph nodes. Physical examination revealed essentially a normal condition except for enlarged suboccipital, post-auricular and posterior cervical nodes. The largest measured 1·5 by 2·0 cm. The epitrochlear nodes were just palpable and a few discrete axillary nodes were felt. The only other possible sign was a slight tenderness of the liver which descended 2 cm. below the costal margin on deep inspiration. As all laboratory examinations, including sternal puncture, failed to assist in a diagnosis, a lymph node was excised. In sections stained by Giemsa stain leishmania were identified. Attempts were made to confirm this finding by examining smears of fluid aspirated from other enlarged lymph nodes. This was unsuccessful. Finally, a second node was excised and in smears of this leishmania were again found. As a diagnosis of leishmaniasis was now firmly established a course of injections of solution of sodium antimony gluconate (90 cc.) was given in spite of the patient's apparent excellent health.

The paper gives no account of the subsequent history of these cases.

*C. M. Wenyon.*

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## FEVERS OF THE TYPHUS GROUP.

WERTMAN, K. **Nonspecific Complement-Fixing Antigen in Embryonic Egg Tissues.** *J. Lab. & Clin. Med.* 1945, Feb., v. 30, No. 2, 112–18. [15 refs.]

The author has found that when relatively crude egg-yolk cultures of rickettsiae are used as antigens in the complement fixation tests for fevers of the typhus group, an appreciable amount of non-specific antigen derived from the egg yolk is retained in the suspension. With the specially sensitive technique, consisting in primary incubation for 18 hours at 4°–8°C., the non-specific antigen may give rise to a false-positive reaction. With the less sensitive technique of incubation at 37·5°C. for one hour, the titre of the reactions is considerably lower. The non-specific antigen is of the Wassermann type, and so, with the sensitive technique, reactions would occur with Wassermann positive sera.

By repeated washing and centrifugation the non-specific antigen is removed ; at the Army Medical School, Washington, PLOTZ [this *Bulletin*, 1943, v. 40, 443] uses a highly purified antigen prepared in this way.

BENGTSON [this *Bulletin*, 1941, v. 38, 682 and 690], in her experiments used antigen purified by only one centrifugation, but as she adopted the less sensitive technique no false positives would have been likely to occur.

*John W. D. Megaw.*

PLOTZ, H., BENNETT, B., WERTMAN, K. & SNYDER, M. **Cross-Reacting Typhus Antibodies in Rocky Mountain Spotted Fever.** *Proc. Soc. Exper. Biol. & Med.* 1944, Dec., v. 57, No. 3, 336–9.

In this important paper the authors throw a flood of light on the immunological relationship between Rocky Mountain spotted fever, epidemic typhus, and murine typhus.

The following table has been extracted from the fuller one contained in the article ; it shows the types of responses to various tests given by sera of persons infected with Rocky Mountain spotted fever (R.M.S.F.).

The tests were :—(1) Weil-Felix tests in which *Proteus OX19* and *Pr. OX2* were used ; (2) Complement-fixation tests for R.M.S.F., epidemic typhus (E.T.) and murine typhus (M.T.) ; (3) Rickettsia-agglutination tests in which epidemic-typhus rickettsiae (E.T.R.) and murine-typhus rickettsiae (M.T.R.) were used, and (4) " Mouse-neutralising tests " showing the richness of the patients' sera in antibodies capable of neutralizing epidemic-typhus toxins derived from yolk-sac cultures (M.N.T. ep. typhus).

*Titres in Tests of Sera from Cases of Rocky Mountain Spotted Fever.*

| Day of disease | Weil-Felix | | Complement Fixation | | | Rickettsial agglutination | | M.N.T. ep. typhus |
|---|---|---|---|---|---|---|---|---|
| | *OX19* | *OX2* | R.M.S.F. | E.T. | M.T. | E.T. | M.T. | |
| (1) 14 } | 640 | 0 | 160 | 0 | 0 | 640 | 640 | 6,510 |
| 15 } | 640 | 0 | 160 | 0 | 0 | 80 | 2,560 | 1,444 |
| (2) 16 | 0 | 0 | 20 | 0 | 0 | —0 | —0 | 2,888 |
| (3) 16 | 2,560 | 160 | 40 | 0 | 0 | — | — | 64 |
| (4) 6 } | 0 | 0 | 0 | 0 | 0 | 0 | 80 | — |
| 49 } | 320 | 40 | 40 | 0 | 0 | 0 | 160 | 6 |
| (5) 40 | 320 | 320 | 160 | 0 | 0 | 0 | 80 | 45 |
| (6) 130 | 40 | 80 | 80 | 0 | 0 | 0 | 80 | 128 |
| (7) 12 | 640 | 0 | 80 | 0 | 0 | 80 | 160 | — |
| (8) 44 | 0 | 160 | 640 | 0 | 0 | 0 | 80 | — |
| (9) 29 | 160 | 2,560 | 80 | 0 | 0 | 0 | 40 | — |

The Weil-Felix responses were of the irregular type usually observed in tick-borne typhus ; neither this nor the rickettsia-agglutination reaction appears to afford a means of differentiating tick-borne from louse-borne and flea-borne typhus. The complement-fixation test has given uniformly consistent results in this respect.

Further evidence regarding the mouse-neutralizing test is given in two other tables from which the following figures have been taken to illustrate the results obtained with sera from persons who had suffered from epidemic typhus and Rocky Mountain spotted fever.

*Titres observed in Mouse-neutralizing Tests (Epidemic Typhus).*

| Sera from Epidemic-Typhus Cases | | Sera from R.MS.F. cases | |
|---|---|---|---|
| Day of Disease | Titres | Day of Disease | Titres |
| 99 | 256 | 57 | 204 |
| 104 | 814 | 106 | 23 |
| 117 | 102 | 120 | 132 |
| 137 | 180 | 130 | 128 |
| 218 | 40 | 217 | 8 |

These figures show that antibodies capable of neutralizing the toxins of epidemic typhus are present in considerable amounts in persons who have recovered from Rocky Mountain spotted fever, so that this test also cannot be relied on for differentiating the two diseases, either in the active stage or after recovery. *John W. D. Megaw.*

DAMON, S. R. & JOHNSON, Mary B. **The Serologic Diagnosis of Endemic Typhus. I. The Use of specially prepared Rickettsial Suspensions and Commercial Typhus Vaccines as Antigens in the Complement Fixation Test.** *J. Lab. & Clin. Med.* 1945, Mar., v. 30, No. 3, 233–6.

The purpose of this study was to compare the relative values of specially prepared rickettsial suspensions and commercial typhus vaccines as antigens in complement-fixation tests for endemic [flea-borne] typhus.

Four of the special suspensions were prepared from strains of endemic rickettsiae and one from an epidemic strain. All the commercial vaccines were of the epidemic type. The sera used in the tests were from (*a*) guineapigs that had recovered from endemic typhus, or (*b*) from active cases of endemic typhus in human patients.

With water-bath fixation for one hour the endemic rickettsial antigen " when freshly made could be used in dilutions of 1–16 to 1–32 ; that is, using 4 units in the test, the unit being the smallest amount which gave complete fixation with the standard serum." There was some loss of antigenicity in stored suspensions, but they were still useful for 4–8 months. The special suspension of epidemic rickettsiae had to be employed in dilutions of 1–1 or 1–2.

Commercial epidemic-typhus vaccines made by Parke Davis and the Lederle Laboratories were found suitable at dilutions ranging from 1–2 to 1–4, and they had good keeping properties. Vaccines made by Eli Lilly and Co. were entirely unsuitable.

The authors suggest that the higher antigenic titres obtained with the special suspensions may be accounted for by their greater concentration or by their being prepared from endemic rickettsiae.

[The latter explanation would seem to be the more reasonable ; two of the commercial vaccines compared favourably with the special suspensions made from epidemic rickettsiae, and a higher-titre reaction would be expected to occur with a homologous than with a heterologous rickettsial antigen. The failure of the Eli Lilly vaccine proves only that it does not contain antigens of the heterologous type. It might possibly be rich in antigen of the strictly epidemic type ; if so it would be an effective vaccine against louse-borne typhus and also an ideal source of antigen for differentiating that disease from flea-borne typhus.

This paper should be read in conjunction with the preceding articles by WERTMAN and by PLOTZ and his collaborators.] *John W. D. Megaw.*

HALLERVORDEN, J. Die pathologisch-anatomischen Veränderungen im Zentralnervensystem beim Fleckfieber. [**The Pathological Anatomy of the Central Nervous System in Typhus Fever.**] *Deut. Militärarzt.* 1943, Jan., v. 8, No. 1, 26–30, 5 figs.

A detailed account is given of the naked-eye and microscopical changes found in the central nervous system in typhus fever. The paper is illustrated by five good reproductions of photomicrographs showing the " typhus nodules " at various magnifications.

Although the nodules are specially associated with the arterioles and capillaries they are not infrequently found in the adjacent tissues, near to, but apart from, the vessels. The author states that by histological examination alone it is not possible to differentiate the cerebral lesions of typhus fever from those occurring in various forms of encephalitis of quite different aetiology.

Many references are made to the findings of other observers.

*John W. D. Megaw.*

SKORIN, I. E. & KORSHUNOVA, O. S. [**Chemotherapy of Typhus exanthematicus (Preliminary Communication).**] *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii.* Moscow. 1944, No. 10–11, 77–82. [In Russian.]

Mice were inoculated intranasally with rickettsial suspension, and various compounds were given by mouth at the same time, and also twice on the following day. Guineapigs were also used in some tests. The chemotherapeutic activity of a compound was assessed by its ability to prolong the survival period of test animals as compared with untreated controls. In all, 56 compounds were tested. Some activity was found in 8 of 13 $N^1$–$N^4$ disubstituted sulphanilamides ; sulphaguanidine lengthened survival time 2·5 times, and 2 of 6 mice survived. Three of 7 diphenylsulphide-sulphoxide sulphones tested also had some effect (survival time lengthened $\times 1{\cdot}7$). The remaining compounds (including $N^1$ and $N^4$ substituted sulphanilamides, azo-substituted compounds, sulphanilamide substituted in the nucleus, organo-metallic derivatives of sulphanilamide and others) were all inactive. *D. J. Bauer.*

PESTANA, B. R. Considerações epidemiológicas a respeito do tifo exantemático em São Paulo. [**Epidemiological Studies in the Exanthematic Typhus of São Paulo.**] Reprinted from *Anais Paulist. de Med. e Cirurgia.* São Paulo. 1944, Oct., v. 48, No. 4, 287–347, 5 figs. [63 refs.] English summary.

The author discusses at considerable length the epidemiology of this fever, which is generally accepted as being immunologically the same as Rocky Mountain spotted fever. While admitting that two types of typhus fever may occur in the region, he argues that there is much to be said for the view that the disease is murine typhus, transmitted by fleas.

The plea for further investigation of the probable vectors, reservoirs of infection, and causal rickettsiae, can be heartily supported, because São Paulo obviously is a rich field for study of the typhus fevers.

The author states that in all the 75 patients who recovered at the isolation hospital, the Weil-Felix reaction was positive with *Proteus OX19* at titres of 1–1,000 to 1–30,000, whereas in the 204 who died the reaction was negative or positive at relatively low titres only. The reaction with *Pr. OXK* was usually negative, but in some patients it was positive at titres ranging up to 1–1,600.

In view of the very high fatality rate and the convincing evidence provided by PARKER and DAVIS and other workers that the disease is closely related to,

if not identical with, Rocky Mountain spotted fever, it seems likely that this is the predominant type of infection, but the coexistence of flea-borne typhus would not be surprising. *John W. D. Megaw.*

KIBLER, M. Vom Fünftagefieber und seiner Bedeutung für die Differentialdiagnose. [**The Differential Diagnosis of Five-Day Fever [Trench Fever] and its Importance.**] *Deut. Militärarzt.* 1943, Feb., v. 8, No. 2, 100–104.

The author states that most of the textbooks deal chiefly with the differential diagnosis of trench fever with special reference to malaria, undulant fever, and relapsing fever; in his own experience difficulty arose most frequently in connexion with influenza, paratyphoid B, typhus fever, and wound sepsis. Special stress is laid on the great variability of the clinical features of the disease, not only in different epidemics but also in the course of the same epidemic.

In the early stages it may be very difficult to exclude influenza, but in trench fever there is often a painful enlargement of the spleen, a localization of the pains in the thighs and shin bones, and diarrhoea. The more sudden rise of the temperature, the absence of mental symptoms, and of the characteristic facial expression observed in typhus fever, help to exclude this disease. Although the incubation period in trench fever is usually less than 14 days it may be as long as 60 days. The blood may be infective for long periods so that it is not safe to employ a patient as a blood donor till two years have elapsed. The periodicity is usually of the five-day type, but it may range from the two-day to the seven-day type, even in the course of the same attack. *John W. D. Megaw.*

BADER, M. & ANIGSTEIN, L. **Specificity of Bullis Fever Rickettsia.** *Texas Reports on Biol. & Med.* 1944, v. 2, No. 4, 405–12.

The authors describe the results of further investigations into the strains of infection whose isolation they have already reported [see this *Bulletin*, 1944, v. 41, 666.]

The strain of rickettsia isolated from *Amblyomma americanum* at Camp Bullis in 1943 [this *Bulletin*, 1943, v. 40, 386], and identified with the strain isolated by LIVESAY and POLLARD [this *Bulletin*, 1944, v. 41, 209] in the same year from a patient diagnosed as suffering from Bullis fever, has now been maintained by guineapig transfer through 22 generations. Using the lyophile technique the authors have found that this strain sometimes showed increased virulence and occasionally caused scrotal swelling in guineapigs. The human strain has been maintained for 15 generations; the responses of inoculated guineapigs have varied from no reaction to definite febrile reactions, often followed by short relapses.

The results are stated to be in conflict with those obtained at the Rocky Mountain Laboratory, where a tick strain " of the same origin " was found to immunize guineapigs against American Q fever. The authors' strains showed no immunological relationship to this disease; they were also unrelated to the rickettsiae of Rocky Mountain spotted fever or of scrub typhus.

Five human volunteers were inoculated with the human strain derived from the lyophilized tissues of infected guineapigs; two of the subjects developed leucopenia (3,700 and 4,800 leucocytes per cmm.); all had a relative lymphocytosis; four developed fever; in one the incubation period was 10 days, fever of an intermittent type lasted 10 days, the temperature rising to 99° or 100°F.; in another there were five spells of fever, each of one day's duration, over a period of 14 days. The type of fever in the other two patients is not mentioned.

Three volunteers were inoculated with the tick strain ; one of them developed fever ranging from 99° to 100°F. " for the first six days," the temperature was then normal for six days and rose again for the last five days of the illness.

In 1944 two strains of rickettsia-like bodies were isolated from *A. americanum* ticks ; the first from a pooled suspension of 1,850 ticks, and the other from a suspension of 600 adult ticks. The guineapig reactions were of the same general type as those obtained with the strain of the previous year. The first strain, after passage through a Berkefeld N filter, caused fever lasting 1–3 days in 5 out of 10 inoculated guineapigs after incubation periods ranging from 6 to 12 days. The other strain could not be maintained in guineapigs, though filtered suspensions caused fever in three out of six guineapigs after incubation periods of 3, 5 and 11 days. Unfiltered suspensions of this strain failed to cause a reaction in any of the five guineapigs that were inoculated.

Better results were obtained with " the next series of guineapigs inoculated with the unfiltered tick suspension." Infection was transferred for nine generations ; about half of the guineapigs had fever of moderate or high intensity after an incubation period of 5–15 days, and inclusion bodies and rickettsiae were found in smears from the lungs.

Among 16 guineapigs that had recovered from infection with this (1944) strain, 15 failed to react when inoculated with the tick strain isolated in the previous year, whereas among 10 controls two died and six others had febrile reactions.

[Final judgment on the infecting agent or agents in Bullis fever seems to be unjustified. Only one strain of rickettsia has yet been isolated from a patient and there appear to have been many failures. From the local ticks several strains of the same type have been isolated by the authors, who, however, refer to the isolation of a tick strain of American Q fever from the same locality, and STEINHAUS and PARKER (this *Bulletin*, 1945, v. 42, 375) have isolated two strains of unidentified filter-passing virus from rabbit ticks in the area. More than one short tick-borne fever may have been included under the name Bullis fever.] *John W. D. Megaw.*

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## YELLOW FEVER.

HECHT, O. & ANDUZE, P. J. Contribución al conocimiento de la fauna Culicidiana de la parte norte de la Guayana Venezolana. [**A Contribution to Information on the Culicidae of N. Venezuela.**] Reprinted from *Bol. Entom. Venezolana.* 1944, Sept. 30, v. 3, No. 3, 105–18. [16 refs.] English summary.

[This paper was abstracted in this *Bulletin*, 1945, v. 42, 465, where a reference is made to a table of 22 species of mosquitoes associated with the investigation of yellow fever. It was recently noticed, during the compilation of a list of blood-sucking arthropods used in yellow fever transmission experiments, that the table referred to contained some errors.]

The authors reproduced a table of 22 species of mosquitoes, which was compiled by SIMMONS and published in " Virus and Rickettsial Diseases," 1939, Harvard University Press, Cambridge, Mass, U.S.A. This gives the names of mosquitoes found naturally infected with yellow fever virus, those shown to be able to transmit it by biting, and those in whose bodies the virus has been shown, experimentally, to persist for various periods. They have marked with an asterisk those species in the list which are known to occur in Venezuela, and those found in the present investigation with a double asterisk. Five of the

mosquitoes in SIMMONS's list, however, appear to have been included by mistake; they are *Wyeomyia bromeliarum, W. oblita, Limatus durhami, Anopheles albitarsis* and *Anopheles tarsimaculatus*. The results of the experiments made with these mosquitoes by DAVIS and SHANNON (this *Bulletin*, 1931, v. 28, 727; 1932, v. 29, 197) were negative, and no later experiments, at least with a different result, appear to have been made; see also the list given above, p. 609.

The following species were collected by the authors: *Anopheles argyritarsis, A. oswaldoi, A. pessôai, A. rangeli*; *Wyeomyia quasiluteoventralis*; *Sabethes belisarioi, S. cyaneus, S. purpureus, S. imperfectus*; *Psorophora champerico, P. cyanescens, P. ferox, P. lutzii, P. discolor, P. onfinnis*; *Haemagogus celeste, H. equinus, H. spegazzinii* (syn. *janthinomys, capricorni*) [see note to Table III, above p. 609]; *Aëdes aegypti, A. leucocelaenus, A. hastatus, A. scapularis, A. serratus, A. fluviatilis, A. terrens, A. upatensis*; *Mansonia fasciolata*; *Culex brevispinosus, C. chidesteri, C. corniger, C. coronator, C. conservator, C. declarator, C. educator, C. maracayensis, C. mollis, C. quinquefasciatus* [*C. fatigans*], *C. surinamensis, C. theobaldi*; *Aëdomyia squamipennis*; *Uranotaenia pulcherrima*; *Megarhinus trinidadensis*: total 42 species.

*J. F. Corson.*

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## DENGUE AND SANDFLY FEVER.

GILBERTSON, W. E. **Sanitary Aspects of the Control of the 1943-1944 Epidemic of Dengue Fever in Honolulu.** *Amer. J. Pub. Health.* 1945, Mar., v. 35, No. 3, 261–70, 4 figs.

The author, who is a Public Health Engineer, gives a vivid account of the energetic and thorough measures of control that were adopted in Honolulu to prevent dengue from becoming a threat to military efficiency.

The infection, which had been absent from the area since the 1912 epidemic, appears to have been introduced by aircraft pilots coming from the Fiji Islands, in July 1943. In spite of prompt measures of control by the local Board of Health, the disease continued to spread and there was a danger of an explosive outbreak, so that the help of the U.S.A. Public Health Service was enlisted. By Sept. 15, a staff of 96 persons was at work. Each man was provided with a kit consisting of a supply of kerosene, Paris green and phenothiazine larvicides, a flashlight and mirror for inspecting water containers, chalk to mark arrows on sidewalks, record sheets, pamphlets of instructions to householders, a pipette and phials for collecting larvae.

All premises were inspected and dealt with every 10 days by squads of about six men with a foreman, and records were made of all breeding grounds of mosquitoes. Special attention was paid to water pockets in various plants and trees. Although more than a million inspections of premises were made, ground pools with earth sides were found to contain *Aëdes* larvae on only four occasions. Adult mosquitoes in and round the houses were dealt with by pressure hand sprays. A crew of 30 men removed 3,600 truck loads of cans, bottles, etc. Roof gutters were removed or perforated, tree and rock holes were filled with cement, all plants harbouring water were removed, and where suitable, pools were stocked with *Gambusia affinis*.

The spread to other islands was controlled by spraying all departing aeroplanes and by local spraying in any locality in which a person coming from Honolulu later developed dengue.

The pupils of schools were enlisted as volunteers ; they detected 30,000 water containers and found larvae breeding in 5,000 of them. The local Press, wireless broadcasts, cinemas, posters and leaflets, were extensively used in an educational campaign.

A sharp reduction in the incidence of the disease followed the use of these measures, and a crippling epidemic was prevented. Less than one per cent. of the inhabitants were attacked, and very few cases occurred among the military personnel. Imported and sporadically occurring cases continued to be found so that it was necessary to persist in the precautions.

*Aëdes albopictus* was undoubtedly a vector, but it seemed to be less effective than *Aëdes aegypti*. For effective control, it appeared to be necessary to reduce the *Aëdes* index to a much lower level than that found effective against yellow fever. *John W. D. Megaw.*

FRANCISCO, R. **Is there Phlebotomus Fever in Puerto Rico ?** *Bol. Asoc. Med. Puerto Rico.* 1944, Dec., v. 36, No. 12, 506–11.

Two cases of short fever in Porto Rico, lasting about two and four days, respectively, are suspected by the author to have been of the sandfly-fever type, because of their short duration and the absence of rash or lymphadenopathy. The author mentions that there had been a " recent epidemic of mosquitoes," and there was no evidence of the occurrence of sandflies.

[In the circumstances dengue fever seems to be a much more likely diagnosis.]

*John W. D. Megaw.*

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## PLAGUE.

WITLIN, B. & WILBAR, C. L., Jr. **Effect of Penicillin on experimentally produced Plague in Guinea Pigs.** *J. Lab. & Clin. Med.* 1945, Mar., v. 30, No. 3, 237–43.

A comparison of the mortality of plague in the three areas, Hamakua District of Hawaii, San Francisco and New Orleans, shows an extraordinary figure for Hamakua of 99·1 per cent. and for the other two, of 49 and 32 per cent., respectively. The Hamakua mortality, 110 deaths among 111 cases from 1910 to 1944, is given as a reason for using this area for studies of plague. Penicillin treatment naturally suggested itself and the test animal was the susceptible guineapig. The result was wholly disappointing whether the penicillin was inoculated before, at the time of, or after the inoculation of 2,500 *P. pestis* organisms, and whether the organisms were inoculated intraperitoneally, intramuscularly or subcutaneously. All the guineapigs died.

*W. F. Harvey.*

ABRAMOVA, S. G. [**The Opsonic Index as a Test of Immunity to** *P. pestis*.] *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii.* Moscow. 1944, No. 10–11, 72–6. [In Russian.]

The author has investigated the value of the opsonic index for detecting the presence of immunity after vaccination against plague. Citrated blood was added to a *Pasteurella* suspension and incubated for 30 minutes ; a stained film was then made and the average number of organisms in one leucocyte was estimated. Thirty-six guineapigs were immunized with a living culture of an avirulent strain of *P. pestis* and the opsonic indices were then determined.

In 16 animals a value of 10 or more was found (maximum 26·2), in 11 animals 5–10, and in 5 animals 1–5. Eleven unvaccinated controls all showed values less than 1. In animals vaccinated with a virulent culture the opsonic index began to rise two days after injection, and reached 55 after 9–13 days.

Twenty-eight immunized guineapigs were given a test inoculation of virulent *P. pestis*; correspondence between the degree of immunity and value of the opsonic index was not exact, thus :—index less than 1, 3 animals, all survived; 1–5, 4 animals, all survived; greater than 5, 21 animals, 18 survived. The value of the opsonic index observed bore no relation to the virulence of the strain of *P. pestis* used in the test. *D. J. Bauer.*

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## CHOLERA.

Lahiri, S. C. **Sulphaguanidine, Sulphathiazole and Extract of Suprarenal Cortex in the Treatment of Cholera.** *J. Indian Med. Ass.* 1945, Mar., v. 14, No. 6, 113–15.

A considerable body of evidence is now accumulating to show the value of sulphaguanidine in cholera. Stress is laid on the necessity, as in all bacterial infections, of early treatment. Once cholera is fully established "treatment resolves itself into combating severe dehydration and accompanying depletion of salts and colloids and their effects." Suprarenal cortex hormone "is said to control the sodium metabolism and water balance of the body" and this was the good reason for its use in a few grave cases of the present series. Altogether, 315 patients were admitted to hospital, of whom 114 were treated with sulphaguanidine, 25 with sulphathiazole and 176 with calomel. Due attention has been paid to the importance of age distribution for comparison of each series, but if we leave this out of count and take simply the total deaths as index to efficacy, we find that the percentages were 14·9, 29·5 and 28 for sulphaguanidine, calomel and sulphathiazole respectively. The dosage of sulphaguanidine was somewhat lower than has been recommended, which was itself an attempt to lower the expense of treatment without sacrificing efficacy. On this basis the dose used was 1 gm. initially, repeated at two-hourly intervals for two more doses and then at four-hourly intervals to give the patient a total of 5 gm. in 24 hours. Later the initial dose was increased to 2 gm. with successive doses of 1 gm. as before, and total dose in 24 hours up to 6 to 7 gm. The extract of suprarenal cortex in the form of eucortone was given intravenously, 2 cc. at a time, in 100 cc. of 25 per cent. glucose followed by saline transfusion, and was thought to have good result. *W. F. Harvey.*

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## AMOEBIASIS AND INTESTINAL PROTOZOAL INFECTIONS.

Cohen, L. & Harrison, Irene. **Gastric Function in Amoebic Dysentery.** *South African J. Med. Sci.* 1945, Feb., v. 10, No. 1, 27–30.

It has often been stated that the hydrochloric acid of gastric juice acts as a barrier against infection with *Entamoeba histolytica*. The authors have investigated this matter, but, on the grounds that the estimation of gastric acidity is a very unreliable indicator of gastric function, subject to considerable variation, they have done so by means of the neutral red excretion test. In this, 5 cc. of a 1·0 per cent. solution of neutral red is injected intravenously,

and the time of first appearance of the dye in the aspirated stomach contents, and the time of maximum concentration, are noted. In normal persons, the neutral red appears within nine minutes, and is at the maximum in 6–20 minutes after injection.

Twenty-five persons, all presenting the clinical criteria of dysentery, and in 11 of whom cysts of *E. histolytica* were found, were tested by this method. The results were within the range of normality except in four subjects, of whom two showed definite hypo-excretion, and two were slightly subnormal. These results show that "amoebic dysentery may, and usually does, occur in the presence of normal gastric function," and that "gastric anacidity cannot be regarded as a significant factor in the etiology of amoebic dysentery."

*Charles Wilcocks.*

Brown, R. L. **Evaluation of Techniques used in the Diagnosis of Enterozoic Parasitism in Children.** *J. Lab. & Clin. Med.* 1945, Feb., v. 30, No. 2, 135–7.

By the use of four techniques (saline films, iodine films, dry slide stained with iron-alum-haematoxylin, and concentration) the author was able to determine 646 specific parasites among 512 children (ages 6 weeks to 12 years) examined. The frequencies in percentages were as follows :—*E. histolytica* 8·0, *E. coli* 35·2, *E. nana* 30·5, *D. fragilis* 3·9, *I. bütschlii* 1·4, *G. intestinalis* 32·2, *C. mesnili* 5·1, *Embadomonas intestinalis* 2·3, *Trichomonas hominis* 1·4, *Ascaris lumbricoides* 0·6, *Enterobius vermicularis* 4·1, *Trichuris trichiura* 0·4, *Taenia* sp. 1·2. Of these parasites it was possible to identify the species by the use of simple saline films in 80 per cent. of cases. By the use of iodine films the species were identified in 35 per cent. of the remainder. The stained film was most instructive, for by its use 96 per cent. of all the parasites found could be identified. Concentration methods were most useful for detecting parasites which would otherwise have been missed. By their use the total number of parasites found by other methods was increased by 11 per cent. *C. M. Wenyon.*

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## RELAPSING FEVER AND OTHER SPIROCHAETOSES.

Slavina, N. S. [**On the Carriage of Spirochaetes of Tick-borne Relapsing Fever by Tick-Vectors in Kazakhstan.**] *Med. Parasit. & Parasitic Dis.* Moscow. 1944, v. 13, No. 5, 85–7, 3 figs. [In Russian.]

Having established the occurrence of tick-borne relapsing fever in Kazakhstan (Central Asia), the author carried out a series of tests with 306 "wild" ticks (*Ornithodorus papillipes*) with a view to determining their rôle as carriers of the spirochaetes. In the course of these experiments the ticks were allowed to feed on guineapigs, which were subsequently examined for the presence of spirochaetes both directly (thick drop method) and by subinoculation of other guineapigs (iso-diagnosis). The infection rate among the ticks was found to be 3·4 per cent., as compared with 2·2 per cent. established for the same locality in 1940. It is pointed out that the feeding method used for the detection of infected vectors is not always reliable, for occasionally ticks failed to infect guineapigs through the bite, whereas an emulsion of their teased-up guts produced infection. It is, therefore, thought that the infection rate among the ticks is actually higher than the figures given above, and that an increase in the incidence of relapsing fever among human beings might be expected in the area in question. *C. A. Hoare.*

Basu, B. C. & Sen, S. **Experimental Studies in Rat-Bite Fever.** *Indian Med. Gaz.* 1945, Feb., v. 80, No. 2, 82–4.

The authors report the course of the disease in various laboratory animals infected experimentally with *Spirillum minus*. Out of 44 guineapigs, 5 died before showing any signs of infection; the remaining 39 became infected. The period of initial attack, when spirilla first appeared in the blood, varied from 1 to 49 days, the average being 10·3 days, and up to 3 relapses were observed. The disease does not seem to produce febrile symptoms in these animals, but there was loss in weight after the organism appeared in the blood. The 44 guineapigs lived from 6 to 101 days, the average being 37·2 days.

Thirteen white rats were inoculated intraperitoneally with infected blood, and 10 became infected after incubation periods of 3 to 17 days. The initial attack lasted from 1 to 6 days and up to 6 relapses were observed. The infected rats lived from 9 to 170 days, the average being 63·1 days. Three of the rats were refractory to repeated inoculations.

Twelve white mice were also inoculated; two died 2 to 3 days later, the remaining 10 became infected after an incubation period of 4 to 6 days. The initial attack lasted for 1 to 34 days, the average being 12·1 days, and up to 3 relapses were observed. The infected mice lived up to 120 days, the average being 34 days.

One kitten was inoculated intraperitoneally and became infected on the 11th day. Its blood remained positive for the next 10 days, after which the animal died. Another kitten fed on infected blood remained free from the disease.

*Culex fatigans*, fed on infected white mice, showed no signs of *S. minus* in the gut within 24 hours, and the organisms were never found in any other part of the bodies of the mosquitoes. Similar results were obtained with rat fleas, although in these insects the spirilla in the gut were still motile after 24 hours.

*E. Hindle.*

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## YAWS.

Rifkin, H. **Yaws in a White Soldier.** *Bull. U.S. Army Med. Dept.* 1945, Mar., No. 86, 81–3.

A white soldier in the tropics got a splinter wound in the finger and in five weeks an ulcer developed there; a month later acute lymphangitis of the arm, with enlargement of the epitrochlear and axillary glands, developed. Microscopical examination showed the presence of spirochaetes resembling *Spirochaeta pertenuis*, and from this evidence and also the appearance of the ulcer, a diagnosis of yaws was made. The Kahn reaction of the blood was strongly positive but the cerebrospinal fluid was normal. A biopsy of an enlarged lymph gland was made and showed spirochaetes. He was given injections of mapharsen in doses of 0·06 gm. (except the first two injections) twice a week for 11 injections (0·615 gm.), and three injections of bismuth. After the third injection of mapharsen the Kahn reaction became negative, and remained so, and after the fifth injection the healing of the ulcer was complete. *J. F. Corson.*

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## LEPROSY.

FAGET, G. H. & POGGE, R. C. **Penicillin Treatment of Leprosy : Clinical Note.** *Pub. Health Rep.* Wash. 1945, Mar. 23, v. 60, No. 12, 324.

" Penicillin was tried at the National Leprosarium in the treatment of 7 cases of leprosy in doses of 50,000 to 100,000 units daily which were continued in some cases for a month's time. No specific beneficial effect could be attributed to this treatment either during the course of medication or for 6 months thereafter.

" Subsequently two of the previously treated patients and two new patients were given much larger doses of penicillin without effect."

## HELMINTHIASIS.

CRAM, Eloise B., JONES, Myrna F. & WRIGHT, W. H. **A Potential Intermediate Host of** *Schistosoma mansoni*. *Science.* 1945, Mar. 23, 302.

There is no record of a human being having acquired schistosomiasis in the United States of America, and none of the known snail hosts exists there ; recent experiments by the authors, however, appear to indicate that a local species of snail, *Tropicorbis havanensis*, is susceptible to infection with *Schistosoma mansoni*.

The snails were " laboratory reared progeny of specimens . . . collected . . . from a lake at the edge of the campus of the Louisiana State University " ; they were exposed to miracidia of *Schistosoma mansoni* in the " water of the finger-bowl aquarium," and cercariae began to emerge from one of the snails a month later. Two other snails of the same species were afterwards infected.

*J. F. Corson.*

ALMY, T. P. & HARPER, J. G. M. **Banti's Syndrome apparently due to Infection with** *Schistosoma mansoni*. *J. Amer. Med. Ass.* 1944, Nov. 11, v. 126, No. 11, 703–5, 4 figs.

An interesting record, chiefly on account of the disease being a medical curiosity in the United States. The patient was an Arab, born near Aden in 1899, leaving there at the age of fifteen and having lived in the United States since 1919. He gave a history of diarrhoea and the passing of blood when 14 years old. Except for a winter cough he was in excellent health till 1941, when his spleen was found to be enlarged. After that he became weak and lost weight, and swelling of the abdomen and legs appeared, with dyspnoea on mild exertion. On admission (1943) the mucosae were pale, liver hard, but not tender, 7 cm. below the costal margin at mid-clavicle line, spleen to the umbilicus ; there was moderate oedema of ankles and over the tibiae. Red corpuscles numbered 3,600,000, leucocytes 4,000 per cmm., with 12 per cent. eosinophiles. After three weeks on iron and liver extract the red cells numbered 4,900,000, leucocytes were still 4,000, but the eosinophiles were down to 4 per cent. Faecal examination revealed scanty ova of *S. mansoni*. Fouadin was given but there was no change in the spleen, the liver or the blood count, except that the eosinophiles rose to 25 per cent. to fall again to 7 per cent. Strength improved and the oedema disappeared. A point of special interest is the chronicity of the disease and the long interval during which the patient seems to have been quite well, for it is almost certain that he had been infected 30 years before [see also this *Bulletin*, 1945, v. 42, 47].

*H. Harold Scott.*

Mazzotti, L. Datos sobre la cisticercosis en México. [**Cysticercosis in Mexico.**] *Rev. Inst. Salubridad y Enfermedades Trop.* Mexico. 1944, Dec., v. 5, No. 4, 283–92, 2 figs. [30 refs.] English summary (2 lines).

In the two and a quarter years, December 1936–March 1939, among 128,025 pigs slaughtered, 5,558 (4·34 per cent.) were measled. In 1938, Labardina found eggs of *Taenia* [species not stated] in 2 per cent. of over 4,000 human faecal specimens; others have recorded their presence in 1·1–2·7 per cent. of those examined. Cysticercosis was found in 13 among 450 autopsies at the Guadalajara Civil Hospital; and in the period March 1938–April 1944, Robles, operating upon 100 cases of cerebral tumour, found 25 due to cysticercosis. Ocular cysticercosis is said to be far from uncommon; it has been found in 2·8 per cent. of autopsies in the City of Mexico. Auto-infection is suggested by the fact that in 63 examinations with the perianal swab 44 revealed ova of *T. saginata* [this *Bulletin*, 1945, v. 42, 134]; one patient with *T. solium* was positive on two successive days, then negative on three days. Of another 131 examinations by the swab 108 were positive (*T. saginata*) and ova were also found elsewhere on the body, the lumbar and hypogastric regions, and on the underclothes. It has been noted that the proglottides of *T. solium* do not emerge spontaneously as do those of *T. saginata*, but only with the faeces. Man would appear to be more susceptible to infestation by ova of *T. solium* than by those of *T. saginata*; this is fortunate seeing that the latter may be present sometimes in large numbers in the perianal and other regions of the body.

*H. Harold Scott.*

Causey, O. R., Deane, M. P., da Costa, O. & Deane, L. M. **Studies on the Incidence and Transmission of Filaria,** *Wuchereria bancrofti*, **in Belem, Brazil.** *Amer. J. Hyg.* 1945, Mar., v. 41, No. 2, 143–9, 6 figs. on 2 pls.

Belem, in the State of Pará, Brazil, has long been known as an endemic centre of filariasis, and *Culex fatigans* abounds there. Though this mosquito is common in other parts of the Amazon Valley, filariasis is not. The present study is based on detailed investigation of 14 parasitized individuals and on a general survey of 5,000 persons examined. Blood samples taken three-hourly from eight patients showed that embryos might be present in considerable numbers from 9 p.m. to 9 a.m., with a peak at midnight. Of six others bled hourly from 6 to 9 p.m. and thereafter three-hourly, all contained microfilariae between 7 p.m. and 3 a.m.; five were positive at 6 a.m., three at 9 a.m. and two at noon.

Next, collectors visited houses in various parts of the city, observed any cases of elephantiasis and took thick blood films from persons, to include all ages and in as nearly equal proportions of both sexes as was possible. Five thousand in all were examined. The results are detailed in the letter press, but the table reproduced gives the information very clearly and will save a long description. The great difference in the existence of elephantiasis recorded among males as among females is explained by the authors' statement that the true rate was not obtained because elephantiasis is more easily concealed in men and much of the data was collected by non-medical assistants. The reader must, therefore, bear in mind that columns 7, 8, 11 and 12 are to be taken with this reservation and columns 9 and 10 are also not quite accurate, though less inaccurate than the others; column 11 gives the incidence of microfilariae among cases of elephantiasis, and column 12 the incidence of elephantiasis among cases of filariasis.

*Number and percentage of persons with filariasis, by sex and type of infection.*

| Sex | Totals Examined | Persons with | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Micro-filariae only | Elephant-iasis only | Both | Microfilariae | | Elephantiasis | | Filariasis | | Elephant-iasis with micro-filariae | Filariasis with elephant-iasis |
| | | | | | Number | Per cent. | Number | Per cent. | Number | Per cent. | Per cent. | Per cent. |
| Male | 2,116 | 238 | 5 | 1 | 239 | 11·3 | 6 | 0·3 | 244 | 11·5 | 16·7 | 2·5 |
| Female | 2,884 | 297 | 53 | 5 | 302 | 10·5 | 58 | 2·0 | 355 | 12·3 | 8·6 | 16·3 |
| Totals | 5,000 | 535 | 58 | 6 | 541 | 10·8 | 64 | 1·3 | 599 | 12·0 | 9·4 | 10·7 |

The incidence of microfilariae in the blood was observed to increase with age; the youngest positive was a two-year-old boy and the youngest with elephantiasis a boy of eleven years. Of 841 under ten years of age, 54 (6·4 per cent.) showed microfilariae, whereas of 2,762 aged 20 years or over, 346 (12·5 per cent.) showed the embryos in their blood.

Among more than a thousand *C. fatigans* captured in Belem and examined, 11·6 per cent. were found infected. This is by far the commonest mosquito there. Of more than half a million mosquitoes collected from 1,641 houses (the average per house was 334) between January and July, over 99 per cent. were *C. fatigans*. Of 563 specimens of *A. darlingi* examined three were found naturally infected with filaria larvae, and of 332 specimens of *A. aquasalis* two were infected. Three other species of *Anopheles*, *A. oswaldoi*, *A. triannulatus* and *A. albitarsis*, were infected experimentally, but were not found infected in nature. Since *C. fatigans* breed well in polluted water, the first thing to do in the way of prevention is to improve the general sanitation and give due attention to the sewerage and drainage systems. *H. Harold Scott.*

GARRATT, E. I. **Clinical Filariasis due to** *Acanthocheilonema* (*filaria*) *perstans*. *Trans. Roy. Soc. Trop. Med. & Hyg.* 1945, Mar., v. 38, No. 4, 287–90.

Infection with *Acanthocheilonema perstans* appeared to be the cause of the symptoms observed in two natives of Northern Nigeria reported in the present paper. One patient was admitted to hospital complaining of pain in the upper part of the abdomen, diarrhoea and vomiting. There was deep tenderness in the epigastric area and the edge of the liver was four fingers' breadth below the costal margin; there was no jaundice or muscular rigidity. As no cause could be found, a course of emetine was started, but in the early morning of the third day after admission the patient complained of severe pain and showed signs of shock. The liver was explored with a needle, blood only being withdrawn, and this was found to contain an excess of polymorphonuclear leucocytes, and numerous living larvae of *A. perstans*, though none were found in the peripheral circulation. Laparotomy was performed but there were no signs of liver abscess. Emetine administration was discontinued after 6 grains had been given and the patient slowly recovered; he was in hospital for 25 days.

The second patient also had upper abdominal pain but no other symptoms. He had had several previous attacks. There were a few larvae of *A. perstans* in the peripheral blood. The liver was explored with a needle, blood being withdrawn and found to contain many larvae of *A. perstans*. He was given a course of anthiomaline and the number of microfilariae in the liver blood diminished greatly. He was discharged recovered 36 days after admission and had no recurrence during three months after discharge.

Both patients had a negative Kahn reaction and both had hookworm ova in the faeces but they seemed to cause no bad effects except a moderate degree of anaemia, and hookworms are very common in the native population.

*J. F. Corson.*

NOTE ON THE DISTRIBUTION OF ONCHOCERCIASIS IN MEXICO.

Dr. Frederic C. BARTTER, Medical Officer in Charge, Onchocerciasis Investigation, Pan American Sanitary Bureau, has asked that the following note be published:

"Numerous textbooks of tropical medicine and parasitology, and numerous articles on onchocerciasis, contain the statement that onchocerciasis exists in the state of Guerrero, Mexico.

" Actually, the disease has never existed in that state, being confined at present to the states of Chiapas and Oaxaca. The error arose through a confusion of names, between the *township* of ' Montecristo de Guerrero ' in the state of Chiapas, and the *State* of Guerrero.

" The first communication in the literature dealing with this subject appears in the *Boletin de la Salubridad Pública de Mexico* in 1926, where it is stated that ' the *township* of Montecristo de Guerrero, in the Department of La Libertad, in Chiapas, contains . . . 4,000 cases of onchocerciasis . . . . '

" In 1928, Charles HARDWICKE, in *Trans. Roy. Soc. Trop. Med. and Hygiene* (XXI, No. 6), quotes (citing reference) the above report : ' In Montecristo de Guerrero State of Chiapas, 4,000 cases, etc.' However, in his summary in the same article, he gives origin to the error, thus, ' . . . its course can be traced along the mountain range of the Sierra Madres, with infected areas in these mountains from the Guatemalan frontier through the states of Chiapas, Oaxaca, and Guerrero.'

" In 1930, Carlos C. HOFFMANN published a map of Chiapas, in which the township of Montecristo de Guerrero was indicated prominently ; and in the accompanying text (*Archiv für Schiffs- und Tropenhygiene*, 1930, v. 34, 461–472) he correctly places the township in La Libertad, in Chiapas.

" However, in the same year, Hoffmann delivered a lecture before the Seventh Latin American Congress, in which he said ' We still lack grounds to establish whether this focus (*i.e.*, the focus in Montechristo de Guerrero, Chiapas—Ed.) is in any way related to the isolated infected regions in Oaxaca, (Larumbe, 1926) or with infected portions of Guerrero (Hardwicke 1928).' He thus carries on the error of Hardwicke.

" Subsequently, as stated above, the error has become prevalent in numerous books and articles.

" The author has been assured by Dr. Salvador González Herrejón, director of the campaign for the control of onchocerciasis of the Mexican Government, that no authenticated case of onchocerciasis has been reported from the state of Guerrero. Although the state of Guerrero borders that of Oaxaca, the onchocerciasis zone in the latter state is relatively confined, and is not known to extend further west than the city of Oaxaca itself.

" The author is indebted to Dr. Eduardo Caballero for the use of his reprint library including several unpublished works of Carlos C. Hoffmann."

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## DEFICIENCY DISEASES.

HOU, H. C. & DJU, M. Y. **Riboflavin Deficiency among Chinese. 3. Urinary Excretion of Riboflavin.** *Chinese Med. J.* Washington, D.C. 1944, Apr.–June, v. 62, No. 2, 140–51.

" Riboflavin excretion studies were made upon a group of out-patients visiting the nutrition clinic, certain hospital in-patients, a group of healthy middle school and college students, healthy hospital staff and others.

" Among 32 healthy students the mean value of urinary riboflavin in 24 hours was $147{\cdot}5 \pm 66{\cdot}8$, 9 hospital staff $186{\cdot}1 \pm 125{\cdot}2$, 9 other healthy individuals $167{\cdot}6 \pm 101{\cdot}3$. The majority of them gave a percentage excretion value of 10 gammas per cent. or more. There appears to be a direct correlation between the pelidisi or nutrition index and the riboflavin excretion.

" Among 41 patients showing eye signs of riboflavin deficiency, 23 or 56·1 per cent. showed zero or only a trace of riboflavin in the urine ; the mean value of urinary riboflavin was $27{\cdot}4 \pm 33{\cdot}5$, which was considerably lower than

the values for normals given above. This is in contrast with a group of 10 patients showing eye signs of avitaminosis A, whose mean value for urinary riboflavin was $160 \cdot 9 \pm 49 \cdot 1$.

"A low urinary riboflavin value was also obtained among a group of 29 patients showing cheilosis and glossitis. The mean value was $39 \pm 27 \cdot 9$.

"The percentage excretion values among ariboflavinosis cases was lower than those of normals. Most of the patients gave a value of 5 gammas per cent.

"The urinary excretion of riboflavin increased immediately after an increased intake through the diet or by the administration of pure riboflavin. When the dosage was large and the administration was continued for a number of days a greater portion of riboflavin was excreted through the urine.

"In many patients showing low riboflavin excretion there were usually found a low vitamin $B_1$ and a low nicotinic acid excretion. In the majority of cases both before and after treatment the excretion of riboflavin ran parallel to the vitamin $B_1$ excretion. The amount of riboflavin excreted was usually in proportion to the urinary volume.

"The daily estimation of riboflavin excretion is an aid in the diagnosis, and in estimating the degree, of riboflavin deficiency."

Hou, H. C. **Riboflavin Deficiency among Chinese. 4. Glossitis.** *Chinese Med. J.* Washington, D.C. 1944, Apr.–June, v. 62, No. 2, 152–65, 4 figs. [11 refs.]

"One hundred and thirty-six cases of glossitis of riboflavin deficiency were observed and treated.

"The outbreak occurred during the winter months of 1941 to 1942, involving mainly young people of ages from 18 to 30 years in institutions where the diets were deficient in vitamin B complex.

"Painful tongue was the main symptom. The tongue usually showed patches of bluish red and magenta red discoloration with flattened papillae or scattered, prominent papillae. The majority showed furrows of various degrees. Other symptoms and signs frequently occurring were sore lips, dry throat and cheilosis. Pericorneal injection of the eye was seen in a number of cases, while blepharitis and seborrheic dermatitis were seen each in two cases. Associated deficiencies of vitamin $B_1$ and vitamin A although mild were seen in the majority of the cases.

"The urinary excretions of riboflavin and vitamin $B_1$ in the cases tested were below normal. The percentage of riboflavin excretion was about 5 mg. per cent. in all but one.

"Glossitis rapidly subsided following treatment with riboflavin. The dosage used was 4·5 mg. daily for the first two days and subsequently 2·3 mg. daily.

"The possibility that glossitis is due to a riboflavin deficiency associated with a mild degree of nicotinic acid deficiency is discussed."

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## HAEMATOLOGY.

Hynes, M., Ishaq, M. & Morris, T. L. **Iron-Deficiency Anaemia in North-West Indian Soldiers.** *Brit. Med. J.* 1945, May 5, 626–8.

A haemoglobin survey was performed on some 1,400 soldiers native of North-West India during the spring of 1944. All the subjects were physically fit and of upwards of one year's service.

Widespread mild anaemia was found, the mean haemoglobin level being 13·42 gm. per 100 ml. Only one-third of the men had over 14 gm., and 14 per

cent. had less than 12 gm. Red cell counts and haematocrit determinations on 341 selected cases revealed that the anaemia was always hypochromic and either normocytic or, less commonly, microcytic ; thus suggesting that it was due to iron deficiency.

Stools were examined for hookworm ova, but the results indicated that hookworm infestation did not usually accompany the mild cases of anaemia, although in most of the more severe cases infestation was present.

A number of the men were treated with iron in heavy dosage for periods of two or three weeks, with consequent marked improvement in the haemoglobin levels in the anaemic cases, whether hookworm infestation was present or not.

The average daily food ration of these soldiers was found to contain over 60 mgm. iron, but of this all except 1 mgm. was derived from vegetable sources.

The authors conclude that most of those cases not due to hookworm infestation were due to inadequate iron intake, the greater part of the dietary iron presumably not being assimilated, possibly owing to the effect of phytic acid or mineral imbalance on the absorption of iron from the cereal diets.

*L. J. Davis.*

ALTMANN, A. **Sickle Cell Anaemia in a South African-Born European.** *Clin. Proc.* Cape Town. 1945, Jan.–Mar., v. 4, No. 1, 1–10, 4 figs. [20 refs.]

Sickle cell anaemia has been described but very rarely in the white race. Altmann records the case of a 24-year-old male white South African who manifested the features of this disease. The patient suffered repeated attacks of fever, jaundice, pains in the limbs and joints, cardiac murmurs and a cerebral vascular accident.

Haematological and biochemical studies indicated a haemolytic anaemia. Examinations of the erythrocytes revealed increased resistance to hypotonic saline, the presence of many target cells and pronounced sickling in wet sealed preparations.

The patient's parents were born in South Africa, and the paternal grandparents came from Scotland. Two of the patient's sisters showed the sickling trait. As a young child the patient was diagnosed as syphilitic and given appropriate treatment. In adult life he had slightly kinky hair, a flattened nose, a markedly mongoloid facies and a coffee-coloured skin. But these appearances are considered by the author to be features of the disease rather than suggestive of coloured blood [?].

*L. J. Davis.*

## VENOMS AND ANTIVENENES.

BOQUET, P. Recherches physio-pathologiques et immunologiques sur le venin de dendraspis. [**Studies on *Dendraspis* Venom.**] *Rev. d'Immunologie.* Paris. 1944–1945, v. 9, No. 1–2, 31–8, 1 fig. [15 refs.]

There are several species of *Dendraspis* in Africa : *D. viridis, D. jamesoni, D. angusticeps* and *D. antinorii.* As their name implies, they are tree-dwellers. They are quick and aggressive, striking at the face, neck, arms and chest of passers in the forest. Though belonging to the proteroglyph Colubridae, they have, like the Viperidae, a mobile upper jaw for erecting the fangs. Experiments were carried out with rabbits, guineapigs and mice, and two species of *Naja* and one of *Sepedon* were used for comparison. The m.l.d. in the rabbit are shown in the accompanying table, from which it will be seen that *N. tripudians* venom is four times as toxic and that of *N. flava* 5–6 times.

| Venoms studied | M.l.d. by intravenous injection, expressed as mgm. per kilo. body weight |
|---|---|
| *Dendraspis viridis* " Dakar 1940 " ... | 0·8 |
| *Dendraspis viridis* " Dakar 1941 " ... | 0·7 |
| *Dendraspis angusticeps* ... ... ... | 0·5 |
| *Naja tripudians* ... ... .... ... | 0·2 |
| *Naja flava* ... ... ... ... ... | 0·15 |
| *Sepedon haemachates* ... ... ... | 0·5 |

The venom kills by causing paralysis and slow asphyxia. It lowers the blood pressure, independent of the nervous centres. The venom of *D. viridis* possesses an anticoagulant property equal in potency to that of *N. tripudians*; that of *D. angusticeps* is 50 times as potent.

Similarities between the symptoms and effects of *Dendraspis* venom and those of other Colubridae render it probable that they possess antigenic factors in common which would be neutralized by *Naja* antiserum (for therapeutic purposes). The author's researches led him to conclude that the venoms of *D. viridis* and *D. angusticeps* act like those of other African Colubridae and of the Indian cobra, but dose for dose the last is the more toxic. That of *D. viridis*, however, lowers the blood pressure (in rabbits), whereas that of *D. angusticeps* is strongly anticoagulant. In preparing polyvalent antivenenes for West and Equatorial Africa it would be wise, therefore, to add an antiserum (prepared from the horse) against *Dendraspis* as well as against *Bitis* and *Naja*.

*H. Harold Scott.*

Del Pozo, E. C., Anguiano, L., G. & González Q., J. Acciones del veneno de alacrán sobre el sistema vaso-motor. [**The Action of Scorpion Venom on the Vasomotor System.**] *Rev. Inst. Salubridad y Enfermedades Trop.* Mexico. 1944, Dec., v. 5, No. 4, 227–40, 4 figs. [19 refs.] English summary.

The mode of action of scorpion venom has not been satisfactorily worked out. Bert in 1865 observed a low and widely varying arterial pressure in dogs receiving injections of the venom, and Wilson in 1904 reported an early and marked increase in pressure succeeded by a gradual fall. Arthus in 1913 and Houssay in 1919 declared that the increased pressure was peripheral in origin, whereas Magalhães in 1935 concluded that it was by central action and indirectly by the " adrenaline-secretory activity of the bulb."

There may be quantitative differences in the venoms of different species of scorpions, but qualitatively they seem to be alike. The authors have carried out several series of experiments on cats under varying conditions, some anaesthetized with dial, some decerebrated, some with the medulla severed or encephalon destroyed, some with the adrenals extirpated or their action eliminated by ligature of their pedicles. The venom, prepared from telsons of the *Centruroides suffusus suffusus*, was injected into a femoral vein. The dose was 100 d.c.l. (*dosis ciertamente lethal, i.e.* the dose causing certain death of an 18–20 gm. mouse in 15–30 minutes.) The general effects were fibrillar and spasmodic contractions of the skeletal muscles, mydriasis, erection of the hair and marked salivation, and death by respiratory paralysis. Vasomotor effects, the chief subject of this study, were an early rise of blood-pressure observed in 11–12 seconds, succeeded by a gradual fall during 8–10 minutes, occasionally longer, and if small repeated doses were injected the initial rise was more prolonged. This rise is shown to be due chiefly to stimulation of the sympathetic neurons

proximal to the ganglia acting in part by way of the vasoconstrictors and in part by stimulating the adrenals. At the same time a cyclical type of respiration set in with prolonged periods of apnoea. The initial rise of pressure was observable even in decerebrated animals and in those whose adrenals had been removed or ligated. If the sympathetic nerves to the ears were severed, the adrenals being left intact, vasoconstriction occurred, but not if the adrenal action was cut off; nevertheless the action is not on the adrenals directly, because, if the glands are left intact but the spinal cord is destroyed, the vasoconstriction does not occur. If the vagi are intact, inoculation of the venom is followed by bradycardia, but not if these nerves are severed.

*H. Harold Scott.*

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## DERMATOLOGY AND FUNGOUS DISEASES.

PARSONS, R. J. & ZARAFONETIS, C. J. D. **Histoplasmosis in Man : Report of Seven Cases and a Review of Seventy-One Cases.** *Arch. Intern. Med.* 1945, Jan., v. 75, No. 1, 1–23, 5 figs. [Numerous refs.]

This article is an important contribution to the study of histoplasmosis and should be read in the original.

During the twenty years following DARLING's discovery in 1905, of histoplasmosis in Panama, no other report of the occurrence of this disease was made until RILEY and WATSON, in 1926 [this *Bulletin*, 1927, v. 24, 68], described a case in the United States, and their report was quickly followed by others. In 1932, DEMONBREUN (*Amer. J. Trop. Med.*, 1934, v. 14, 93) succeeded in cultivating the causative fungus, *Histoplasma capsulatum*, and from this time onward the number of cases reported annually in the United States has greatly increased and the disease has been recognized in Brazil, Central America, Java, England, Argentine, Mexico, Rhodesia, the Philippines and Austria. The marked increase in the number of reported cases is not attributed to an actual increase in the incidence of the disease but to greater accuracy in diagnosis.

The authors give a tabulated analysis of 71 cases : 56 collected from the literature and 15 hitherto unpublished. They also describe, in clinical and pathological detail, 7 cases which came under their personal observation and three other cases. There is no indication of the source or mode of infection. The fungus has never been found vegetating saprophytically in nature but the disease has been identified on three occasions in the dog, and a yeast-fungus bearing a resemblance to *Histoplasma* has been seen in the tissues of a mouse, a rat and a ferret. Histoplasmosis occurs sporadically and persons of all ages are susceptible ; in a series of 60 cases, 11 were in infants under 1 year old. The white race has provided the great majority of the patients and the disease seems to be commoner in males than in females. There is no known occupational predisposition but agriculture has provided more patients than any other calling.

The disease may attack any organ of the body and all have been involved in some case or another. It may be limited to a single tissue such as the adrenal glands or several tissues may be affected, and the clinical signs and symptoms will depend on the distribution of the lesions. The lungs are often affected and pulmonary tuberculosis may be simulated, or it may even co-exist with the histoplasmosis. Ulcerating granulomata, frequently met in the mouth, pharynx, larynx or intestine, may suggest malignant disease or tuberculosis, and the frequent general enlargement of the lymphatic glands and the spleen may lead to the diagnosis of leukaemia or Hodgkin's disease, while histoplasmosis of the adrenals may be reflected clinically only in the signs of adrenal insufficiency. In

three cases, *H. capsulatum* caused vegetative endocarditis affecting the auriculo-ventricular valves, and in one of these cases the diagnosis of subacute bacterial endocarditis had been made.

The diagnosis of histoplasmosis depends on the identification of the fungus in microscopical preparations or in culture from the lesion, and the most useful material for this purpose is morbid tissue obtained by biopsy. The parasite may sometimes be found in smears of the peripheral blood or sternal bone marrow, but diagnosis should not be made dependent on this method of examination alone. Inoculation of morbid material into an animal susceptible to the infection, such as the mouse, rat or guineapig, may be used when the material is too grossly contaminated for direct culture tests. Dermal hypersensitivity to filtered extracts of cultures of *H. capsulatum* may prove an aid to diagnosis.

The prognosis is bad, for the disease is almost invariably fatal. Treatment has not proved effective but there seems to be some promise of usefulness in radiotherapy and in drugs of the antimony group. *J. T. Duncan.*

Schlumberger, H. G. **A Fatal Case of Cerebral Coccidioidomycosis with Cultural Studies.** *Amer. J. Med. Sci.* 1945, Apr., v. 209, No. 4, 483–96, 9 figs. [17 refs.]

" A fatal case of disseminated coccidioidomycosis is reported in which the outstanding lesions were found in the brain. Fifteen additional examples of intracranial infection by the fungus are listed. The organism was isolated and both mycelium and spherules grown in culture using the roller tube apparatus of Gey. Hamsters were very susceptible to the fungus, frogs were refractory. Neither in the patient nor in the experimental animals was there evidence of mycelial growth."

Kunstadter, R. H. & Prendergrass, R. C. **Primary Coccidioidomycosis : a possible Pediatric Problem.** *J. Amer. Med. Ass.* 1945, Mar. 17, v. 127, No. 11, 624–7, 1 fig. [13 refs.]

Iriarte, D. R. Consideraciones sobre Paracoccidiosis. Observaciones del Servicio de Otorrinolaringologia del Hospital Vargas. [**Paracoccidiosis.**] *Bol. Laboratorio Clinica " Luis Razetti."* Caracas. 1945, Feb., v. 13, No. 16, 277–85, 6 figs.

[*Paracoccidioides*, of which there are several species known, produces a granulomatous condition which may be local or more generally distributed ; it occurs chiefly in South America and particularly in Brazil. The species more concerned in the generalized forms are *P. tenuis* and *P. braziliensis*, with the localized form *P. cerebriformis*]. The first cases seen in Venezuela were discovered by O'Daly in 1937 in post-mortem examinations, and the first in a living body was one described by the author and Rodriguez in 1939 [the author makes this statement, but does not give the reference] in a patient with lesions localized to mouth and larynx. In this form the lips are infiltrated, thickened and hard and the mouth is invaded, tongue, palate, pharynx and larynx. Some authorities maintain that the lungs are first involved and the upper passages and the mouth secondarily, but the majority favour the idea of the mouth lesion being primary and the lung involvement (when it occurs) as secondary.

The author gives brief notes of two cases. The first was in a negro, 32 years of age, who stated that ten months before coming to hospital he noticed ulceration at the left angle of the lower lip ; later the upper lip and the gums became involved ; for six months his voice had become hoarse and he had difficulty in swallowing. The epiglottis was infiltrated and ulcerated, as were

the arytenoids. A biopsy specimen of the epiglottis showed the lesions to be paracoccidioidal granulomata. Sulphapyridine was given ; the lesions cicatrized, the infiltration subsided, the hoarseness and dysphagia disappeared. [The dosage is not stated beyond that " 38 pastilles " were given.]

The second case was very similar. The patient was a white man of 61 years, who had had ulceration of the upper lip for a year ; later, the palate, hard and soft, was invaded ; he had been hoarse for three months and had had difficulty in swallowing for 2½ months. Examination revealed ulceration of the right nostril, the palate, epiglottis and arytenoids. Biopsy proved the cause. This time sulphathiazole was given, " 120 pastilles or 60 grammes " and, as in the other patient, ulcers cicatrized and the symptoms cleared up. Radiograms are reproduced designed to show the condition on entering the hospital and after treatment, but are not very clear. *H. Harold Scott.*

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## MISCELLANEOUS DISEASES.

FAIRLEY, N. H. **Medicine in Jungle Warfare.** *Proc. Roy. Soc. Med.* 1945, Mar., v. 38, No. 5, 195–8 (Sect. of Epidem. & State Med. 13–16).

During six months' campaign in the Huon Peninsula and the Markham-Ramu Valley in New Guinea, the chief diseases were : malaria (60·5 per cent.), dengue (17·5 per cent.), dysentery and diarrhoea (6·5 per cent.), scrub typhus (2·5 per cent.) and skin and other diseases (13 per cent.).

*Bacillary dysentery* was spread chiefly by polluted water. The administration of sulphaguanidine lowered the incidence and severity of the disease and " it is now only possible to isolate dysentery bacilli in approximately 10 per cent. of diarrhoeal cases admitted to hospital." Sulphaguanidine was very effective in the severe epidemic among the Australian soldiers fighting over the Owen Stanley Ranges in 1942 ; the epidemic was controlled within 10 days. The drug is expensive, but it is absolutely safe for Field use ; no toxic symptoms of any importance occurred, there was no anuria even in dehydrated patients and the fatality rate of treated cases is 1 : 5,000.

*Scrub typhus.*—" This is the only disease which is killing troops with regularity in the south-western Pacific area " ; the average case mortality is about 8 per cent., but it varies in different areas from 0 to 30 per cent., apparently owing to variation in the virulence of the rickettsiae. For preventive measures, di-butyl phthalate is more persistent in clothing, after immersion in water or washing, than di-methyl phthalate. " When wearing treated clothing (socks, trousers and shirt) it is possible to lie down in country swarming with mites without getting a single bite." Blankets also require treatment. Mites causing scrub itch are not necessarily concerned with scrub typhus.

Scrub typhus is restricted to small areas, often widely separated, so cases should be reported promptly and the suspected area put out of bounds. No specific treatment is known.

*Dengue*, though not fatal, causes much incapacity among troops. *Aëdes scutellaris* is a vector in New Guinea ; it breeds in rain water in casual receptacles —tins, coconut shells, &c.—and in the axils of branches of mango trees ; it bites in the daytime and appears not to fly further than 200 yards. Experiments on volunteers confirmed that *Aëdes scutellaris* is a vector, and failed to incriminate *Armigeres breinli* and *Aëdes auremargo*. Antimosquito measures were effective.

*Malaria.*—" Throughout the Milne Bay and Buna-Gona campaigns in 1942 malaria casualties far exceeded battle casualties, the hospital admission

rate in three to four months almost equalling the total strength of the Forces involved. In these campaigns suppressive treatment consisted for the most part of quinine grains 10 daily. Later, in 1943, there were very heavy malaria casualties in the Ramu and Markham Valley and the Huon Peninsular campaigns when the suppressive drug regime consisted of 0·1 gramme of atebrin (mepacrine) daily on six days of the week."

A research centre was established in Northern Queensland to test the value of all known antimalarial drugs ; volunteers took the drug before, during and for 23 days after exposure to infection by bites of infective mosquitoes. Quinine, 10 grains daily, did not protect against infection with *Plasmodium falciparum* by 10 bites of *Anopheles punctulatus* var. *typicus* ; fever with parasites in the blood always occurred within the usual incubation period, but fever and parasites disappeared with doses of 50 grains of quinine daily.

Quinine in 10 grain doses daily suppressed benign tertian fever in two-thirds of the cases, while 5 grains failed. Atebrin, however, was found very effective ; 0·1 gm. daily or on six days of the week, was taken before, during and for 23 days after the last infective bite. Benign tertian fever thus was suppressed, but it always appeared 14 to 44 days later, and parasites appeared in the blood 19 to 46 days later. Subtertian fever was also suppressed with the same dosage and did not appear later, nor did the injection of 200 cc. of the blood of the bitten volunteers infect others ; infection was not prevented, because subinoculation from the 7th to 10th day infected other volunteers, and since other tests showed that the bitten volunteers were susceptible, it is concluded that they were infected and cured. Mixed infection with *P. vivax* and *P. falciparum* was also suppressed, even when exhausting conditions—fatigue, cold, anoxia, loss of blood—were present. About 30 days later, however, every volunteer developed benign tertian malaria, but no subtertian parasites were found.

Confirmation of these results has been obtained in the Field ; the admission rate to hospitals in New Guinea fell from 740 per 1,000 per annum in December 1943, to 26 per 1,000 in November 1944. Other factors—less fighting and mosquito control—also contributed to the good health record.

*J. F. Corson.*

MASTER, A. M. **Medicine in the South Pacific.** *U.S. Nav. Med. Bull.* 1945, Feb., v. 44, No. 2, 308–15.

The author landed on one of the Solomon Islands in December 1943, at the beginning of the rainy season ; the shade temperature was 85°–90°F. and the relative humidity was 80 per cent. The annual rainfall of the Solomon Islands is said to exceed 160 inches.

Malaria control had already been established, and mosquitoes were not numerous. Prefabricated steel buildings were erected by the medical staff, roads constructed, and a water supply established, the work being done in mud which was sometimes 3 feet deep.

Among non-tropical diseases, upper respiratory infections—acute pharyngitis, acute tonsillitis, acute tracheitis, and acute catarrhal otitis media—were common ; prompt treatment with sulphadiazine enabled the men to continue working. Primary atypical pneumonia also occurred and was easily distinguished from lobar pneumonia by X-rays and by its mild clinical course. Diarrhoea was also common and was successfully treated with sulphadiazine or sulphaguanidine, both being effective. Only four cases of amoebic dysentery were diagnosed.

Various skin affections—cuts, abrasions, prickly heat, impetigo, tropical ulcers and fungous infections—were common ; here also sulphadiazine proved

very effective. Pubic lice were troublesome at first, but were easily controlled by the aerosol bomb.

*Malaria.*—There were 500 cases of malaria in the first 3½ months, practically all being benign tertian ; thick films only were used for diagnosis. There were no cases of blackwater fever. Treatment with atabrine [mepacrine] was effective but there were many relapses.

*Typhus.*—Cases of mite-borne typhus were admitted from neighbouring islands ; the illness was severe and convalescence slow.

*Worms.*—Hookworm was common, about 10–20 per cent. of the Marines who had been in the jungle for six months or more being infected, while 90 per cent. of natives in the labour battalions had hookworm ova in the stools. There were two cases of infestation with *Strongyloides stercoralis*, and in one the larvae were found in the sputum. *Diphyllobothrium latum* and *Hymenolepis diminuta* were also seen, and there was one case of larva migrans due to the cat or dog hookworm.

Organic heart disease was rare, but tachycardia, as a symptom in the " effort syndrome," was common. *J. F. Corson.*

i. Bally, P. R. O. *Catha edulis. East African Med. J.* 1945, Jan., v. 22, No. 1, 2–3.
ii. Carothers, J. C. **Miraa as a Cause of Insanity.** *Ibid.* 4–6.

i. Miraa is one of several local names (others are muirugi, khat, cafta) of a tree (*Catha edulis*), usually some 20 feet in height, occasionally three to four times this, indigenous in Africa. Its leaves and twigs may be chewed, or infused as Bushman's Tea, or smoked, or the leaves may be made into a sweet with honey. It induces, particularly when chewed, " a happy and mellow friendliness and an increased intellectual vigour and acuity." It is not a narcotic ; in fact, addicts suffer from insomnia.

ii. The author describes two cases of mental disturbance in addicts to this drug. The first patient was a male Somali, approximately 20 years of age, admitted in an excited, aggressive state ; in two days he was quieter but garrulous and was well enough to be discharged after 11 days. A little more than a week later he was re-admitted with similar symptoms accompanied by haughtiness, excessive politeness and grandiose hallucinations. This time he was four weeks in recovering. Nearly five months later he was again under observation with like symptoms, but this time recovery was not complete for 3½ months.

The second patient was a man of 30 years who was seen in four attacks at brief intervals. In his case recovery was more rapid : 13 days, 4 weeks, 2 weeks and 12–13 days respectively. [Nothing is said regarding treatment, if any was adopted.] *H. Harold Scott.*

Heisch, R. B. **A Case of Poisoning by** *Catha edulis. East African Med. J.* 1945, Jan., v. 22, No. 1, 7–9.

The author records a fatal case of poisoning by *Catha edulis*. This contains three known alkaloids—cathine, cathinine and cathidine. Except that it is not an analgesic the action is very like that of *Erythroxylon coca*. Chewing it causes excitement, diminishes the sensation of fatigue, allays hunger and induces addiction. The author states that only the green stalks are used and that the dried plant is probably inert, but an editorial [see below] and a brief note by Dr. Bally [see above] in this issue of the *East African Medical Journal* state that the leaves and twigs are chewed and the dried leaves smoked.

The patient in the present record was an elderly Arab admitted in an excitable, inarticulate condition, with spasmodic movements of the limbs; the pupils were normal in size and reacted to light and convergence, but sluggishly. Legs and arms were spastic [but deep reflexes were not exaggerated]; he was hypersensitive to sound, and hyperaesthetic. Gastric lavage removed a large quantity of stalks of the plant. His temperature was 101°F., but no malaria parasites could be seen. Two days after admission he passed into coma, for which no cause other than the poison plant could be found, and two days later he died without recovering consciousness. [There is, unfortunately, no account of any post-mortem findings, or even of an autopsy being made.]

*H. Harold Scott.*

East African Med. J. 1945, Jan., v. 22, No. 1, 9–10. **The Need for the Control of Khat.**

This is a short editorial on the subject of the cultivation of *Catha edulis* and its control. The question is not altogether a simple one because some people regard it as a harmless stimulant and compare it with alcohol. But alcohol is not so readily obtainable by irresponsible natives and is too expensive to be the cause of harmful addiction. On the other hand, the plant is grown or can be cultivated on a large scale and is thus easily obtained—in fact, it is hawked around in towns—it soon engenders addiction and leads to mental disturbances and, as Dr. Heisch has described (see above), perhaps to a fatal result. The consumption of it is increasing in East Africa and its harmful effects are becoming recognized; something, therefore, should be done officially to stop, or at least control, its cultivation and use. Ten years ago a resolution was passed to this end by the Meru Native Council, and more recently by the Isiolo Native Council, making it an offence to possess the plant; but for all the effects these resolutions have had they might be a dead letter. It is now suggested that its cultivation should be limited and that its sale should be restricted to a few persons under a licence. "Absolute prohibition of the drug would seem to be inadvisable for various reasons" writes the Editor [but these reasons are not stated].

*H. Harold Scott.*

Wright, F. J. **Haemoglobinuria in Typhoid Fever.** *East African Med. J.* 1945, Jan., v. 22, No. 1, 24–6.

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## GENERAL ENTOMOLOGY.

Bull. U.S. Army Med. Dept. 1945, Mar., No. 86, 13–14. **Composition of Insecticides containing DDT.**

Information is given regarding the composition and uses of nine preparations of D.D.T. insecticides. Nos. 1 and 2 are powders containing 10 per cent. of D.D.T. in pyrophyllite [an aluminium silicate]; no. 1, put up in 2-oz. tins for personal use against lice in clothing, no. 2, in 5-lb. containers for mass delousing. No. 3 is 100 per cent. D.D.T. powder in 10 lb. containers for dissolving in suitable oils to make 5 per cent. to 0·5 per cent. D.D.T. sprays for use as insecticides or larvicides. No. 4 is a powder containing 10 per cent. of D.D.T. in talc [magnesium silicate]; for use it is diluted with an inert dust to make a 2 per cent. D.D.T. dust for areas where mosquitoes breed. No. 5 is a 5 per cent. solution of D.D.T. in kerosene for use primarily in fly and mosquito control but can also be used against other insects; it can be applied either by a spray

or a paint-brush. No. 6 contains 1 per cent. of D.D.T. and 2½ per cent. of thanite in refined kerosene for use in a flit-gun type of sprayer. No. 7 contains 6 per cent. of D.D.T., 68 per cent. of benzyl benzoate, 12 per cent. of benzocaine, and 14 per cent. of " Tween-80 " ; it is diluted with 5 parts of water to form a spray for body lice and for scabies. No. 8 contains 3 per cent. of D.D.T., 2 per cent. of pyrethrum (20 per cent. extract), 5 per cent. of cyclohexanone, 5 per cent. of hydrocarbon oil, and 85 per cent. of " Freon-12." It is contained, under pressure, in 1 lb. steel cylinders fitted with a release valve, and is for use against mosquitoes and other biting flies. No. 9 contains 25 per cent. of D.D.T., 10 per cent. of " triton X-100," and 65 per cent. of xylene. It is used for impregnating underwear and will keep it louse-proof for some months through 6 or 8 ordinary launderings. For use it is diluted with 11 parts of fresh or sea water to make a 2 per cent. emulsion. *J. F. Corson.*

Bushland, R. C., Eddy, G. W. & Knipling, E. F. **Tests with Synergists for Pyrethrum against the Body Louse.** *J. Econom. Entom.* 1944, Aug., v. 37, No. 4, 556–7.

Three pyrethrum synergists, known to be effective in fly sprays, were added to a pyrethrum louse powder and have proved to be effective. The synergists concerned were sesame oil, DHS activator (ethylene glycol ether of pinene) and IN930 (N-isobutylundecylenamide). The testing method involved applying 3·0 gm. of a pyrophyllite powder [aluminosilicate] containing the insecticidal ingredients, to the inside of a sleeve made of heavy cotton underwear material. Twenty-five young adult lice were placed in the sleeve, which was then fixed on the host's arm with adhesive tape. After twenty-four hours the surviving lice were counted. Twelve tests on each powder showed that 0·25 per cent. pyrethrins on pyrophyllite gave a kill of 68 per cent., with 2 per cent. of synergist added the kills were :—with IN930, 100 per cent. ; with DHS activator, 94 per cent., and with sesame oil, 94 per cent. Pyrophyllite containing 2 per cent. synergist alone was non-toxic to lice. It was later found that powders containing 2 per cent. IN930 and 0·01 per cent. pyrethrins or more were completely lethal to lice. Dusts containing only 0·005 per cent. pyrethrins plus 2·0 per cent. IN930 have given 100 per cent. kills in a number of tests ; with 0·25 per cent. IN930 the kill was about 68 per cent. It was concluded that 2 per cent. IN930 increased the toxicity of pyrethrins in the dusts by about one hundred times.

It was found that powders containing 1·0 per cent. pyrethrins remained effective for four days' wearing, and that this period was extended to eight days for a dust containing 0·2 per cent. pyrethrins and 2 per cent. IN930.

*W. A. L. David.*

Knipling, E. F. & Dove, W. E. **Recent Investigations of Insecticides and Repellents for the Armed Forces.** *J. Econom. Entom.* 1944, Aug., v. 37, No. 4, 477–80.

The shortage of pyrethrum and rotenone, coupled with an increased war time demand, stimulated the search for insecticides suitable for controlling insects and other arthropods of medical importance, notably body lice, mosquitoes, houseflies, sandflies, fleas, mites and ticks. The work described can be divided into two main projects (1) body louse control, (2) repellents for use against various biting insects.

*Louse control.*—At first a powder for individual application was preferred. Pyrethrum and rotenone and also several hundred synthetic organic compounds were tested. The early tests showed that pyrethrins and rotenone impregnated

on pyrophyllite were about equally effective, but that pyrethrins were preferable since rotenone was slower in action and frequently caused scrotal dermatitis. It was found that the pyrethrum synergist isobutylundecylenamide (IN930), known to be effective in fly sprays, increased the effectiveness of the pyrethrum louse powder also, and was superior for this purpose to 300 other compounds tested [see also BUSHLAND, EDDY and KNIPLING above]. The addition of 2 per cent. IN930 to the powder made 0·2 per cent. pyrethrins in the dust superior to 1 per cent. pyrethrins without activator. Later 2, 4-dinitroanisole was added as an ovicide. The final formula, known as MYL, contained 0·2 per cent. pyrethrins, 2 per cent. IN930, 2 per cent. 2, 4-dinitroanisole and 0·25 per cent. Phenol S (the latter as an antioxidant) in pyrophyllite. The powder was also effective against the crab louse (*Phthirus pubis* L.) and the head louse (*Pediculus humanus humanus* L.).

*Repellents.*—The main emphasis was on the development of mosquito repellents, which would be superior to citronella oil. Some of the early preparations were effective but also toxic, however, after extensive tests with *Aëdes aegypti*, *Anopheles quadrimaculatus* and also *Stomoxys calcitrans*. Three effective and safe repellents were found—dimethyl phthalate, *Rutgers 612* and *Indalone*. These three substances do not provide equally effective protection against the various species tested. Dimethyl phthalate proved to be a good flea repellent. *Indalone* was one of the more effective repellents against flies, but was of little value against *A. quadrimaculatus* ; for the latter insect dimethyl phthalate was most effective. *Rutgers 612* repelled *Aëdes aegypti* most effectively. The period of complete protection against *Aëdes* given by the three repellents ranged from three to five hours. When applied to clothing they prevented biting through the treated fabric for about one week. The duration of protection, however, depended greatly upon the conditions of the test ; on perspiring subjects, for example, it was much shorter.

All three repellents gave good protection against chiggers (*Eutrombicula* and *Acariscus* spp.) for short periods when applied to the legs and arms. The preferred procedure, however, is to apply dimethyl phthalate as a barrier on the socks, cuffs of trousers, sleeves and other openings in the clothing through which chiggers could crawl. An application requires 1·5–2·0 ounces and remains effective for a week. Similar methods proved effective against larval and nymphal stages of the tick *Amblyomma americanum*, but not against adults.

The fleas *Ctenocephalides canis* and *C. felis* were also repelled when the same three repellents were applied to the skin, on clothing these substances gave more prolonged protection. *W. A. L. David.*

BISHOPP, F. C. **Insect Problems in World War II with special references to the Insecticide DDT.** *Amer. J. Pub. Health.* 1945, Apr., v. 35, No. 4, 373–8.

A general account.

KAHN, M. C., CELESTIN, W. & OFFENHAUSER, W. **Recording of Sounds produced by certain Disease-carrying Mosquitoes.** *Science.* 1945, Mar. 30, 335–6.

In this extremely interesting note the authors report their investigation of the sounds made by certain mosquitoes. They were led to this in the hope that sound could be used to attract mosquitoes to spots prepared with DDT, and thus, perhaps, to avoid the necessity of indiscriminate spraying of buildings and the consequent destruction of insects which are rather beneficial than harmful. Records were made, by means of modern electrical apparatus, of sounds audible and inaudible to the human ear, and the authors have found that each genus and species has tonal emanations so distinctive that they can readily be

distinguished, as can the sounds produced by males and females of the same species. These seem to be mating calls, or warnings of danger, or calls of anger. All the calls are within the cycle range of the human ear, but some are far too feeble to be detected.

The noise of a single female will cause the males of the same species to burst into an answering chorus, and the males turn the antennae and hypopygium in the direction of the female. The sounds may be made when the mosquito is in flight, or by the beating of wings when it is resting, or by the rubbing of tarsi against the wing, but there are certain pure bird-like sounds whose origin is not yet known.

The work is being continued. *Charles Wilcocks.*

GETTING, V. A. **Insect Vectors of Disease.** *New England J. of Med.* 1945, Mar. 15, 22 & 29, v. 232, Nos. 11, 12 & 13, 315–21 ; 344–50 ; 373–8. [178 refs.]

PARROT, L. & DE JOLINIÈRE, P. B. Notes sur les Phlébotomes. XLVI. Nouveaux Phlébotomes du Hoggar. [**New *Phlebotomus* in the Hoggar.**] *Arch. Inst. Pasteur d'Algérie.* 1945, v. 23, No. 1, 56–63, 5 figs.

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## LABORATORY PROCEDURES.

LILLIE, R. D. **The Deterioration of Romanovsky Stain Solutions in various Organic Solvents. Purification of the Thiazins and Spectra of Purified Dyes. Spectroscopic Data on Paired Mixtures of Purified Thiazins and on Commercial Thiazins.** *Suppl. No. 178 to Pub. Health Rep.* Wash. 24 pp. [Numerous refs.]

This is an account of spectroscopic examination of Romanowsky stains. In the first paper are recorded the results of an investigation of the changes that may occur in old solutions of Wright's stain ; in watery solutions a shift of the thiazin absorption band away from the red end of the spectrum was noted as well as a relative decrease in this absorption band as compared with the eosin band. Solutions of various Romanowsky stains in various solvents were studied both at room temperature and at 55°C. or higher. The solvents were various alcohols, glycols and glycerol. The findings are given in detail in the text and in tables in an appendix. " Solutions in ethanol and diethylene, triethylene and dipropylene glycols are apparently more stable at room temperature than solutions in methanol, but at higher temperatures ethanol and methanol mixtures with 40 to 50 per cent. of glycerol were the only ones giving satisfactory stability." " Solutions containing 1·2 gm. per 100 cc. in ethanol glycerol or methanol glycerol stain optimally in about half the time required by 600 mg/m 100 cc. solutions [the usual strength]." " Schüffner's granules are better shown in 1-hour staining at 1 : 50 dilution with 800 mg/100 cc. solution in either solvent [methanol or ethanol with glycerol] than in standard Giemsa stains."

The second paper records an attempt to prepare pure samples of methylene blue, azure B, azure A, azure C, and thionin, while in the third paper mixtures of these purified stains were examined " in an attempt to provide comparison ctandards for commercial and laboratory samples of these dyes." These dyes sould not be prepared in the dry form so mixtures of the solutions were used ; the results are shown in a table. *J. F. Corson.*

## BOOK REVIEWS.

VARGAS, Luis. Simulidos del nuevo mundo. [**The Simuliidae of the New World.**] Monografia Num. 1 del Instituto de Salubridad y Enfermedades Tropicales. 241 pp., 10 pls. 1945. Mexico, D.F.

The title of this book is a little misleading, though not to the extent of being inaccurate. It contains two parts; the first is a summary of our knowledge of the biology, morphology, etc., of the Simuliidae; the second contains a summary of proposed classifications of the family, a catalogue of sub-families, tribes, genera and sub-genera proposed by various authors within the family and, finally, a catalogue of New World species. It must be emphasized that there are no keys or descriptions for the identification of species. The author's aim has been to collect available information and present it in a form easily distributed to workers concerned with onchocerciasis in Central America and Mexico: he is not presenting new results of his own investigations except incidentally, for original contributions by him have appeared in a number of papers elsewhere.

Much of the material in the first part, that on biology, etc., consists of actual quotations from published work of other authors, or re-statements of their findings and opinions. It would be invidious to start to comb through this part of the book and comment on these selections, especially as the reviewer is ignorant of the library facilities at the author's disposal; a few factual comments may, however, be made.

The reviewer notes that the work of the following authors is not mentioned: METCHNIKOW (*Zeits. f. Wiss. Zool.*, 1866, v. 16, 392–406) in which the embryology of a simulid is described in the careful descriptive style of the period, PULIKOVSKY (1927, *Zeits. Morph. u. Oekol. Tiere*, 1927, v. 7, 384–443; *ibid.*, 1929, v. 13, 655–664) and on the pupal respiratory organs, VOGLER (*Mitt. Schweiz. Ent. Gesell.*, 1887, v. 7, 277–282) on the pupal tracheal system, WAGNER (*Zool. Jahrb.*, 1925, v. 12, 441–486) on larval respiration, WILHELMI (*Die Kriebelmückenplage*: 1–246, 1920, Fischer, Jena) summarizing our knowledge of the Simuliidae and which has a long and valuable (though occasionally inaccurate) bibliography, and WILHELMI & SALING (*Zeits. f. Wiss. Zool.*, 1928, v. 132, 329–354) supplementing and bringing up to date WILHELMI's book and the bibliography therein.

The author adopts the nomenclature applied to the male external genitalia by GIBBINS (*Ann. Trop. Med. Parasit.*, 1935, v. 29, 317–325). This is a pity; the nomenclature adopted by DE MEILLON (*Publ. S. Afr. Inst. Med. Res.*, 1934, v. 6, 253–263 and 323–347; v. 7, 208–215 and 393–402) which closely resembles that of EDWARDS (*Dipt. Pat. S. Chile*, 1931, Pt. 2, Fasc. 4, 121–154) though perhaps not perfect, is to be preferred. Some of GIBBIN's nomenclature, in which he called the median structures "posterior-, median- and anterior phallosome," seems to have been derived from Professor PATTON's use of these terms in his writings on external genitalia of Cyclorrhaphous Diptera. The simulid genitalia should of course be compared, in the first instance, with those of other Nematocerous Diptera.

A few more figures—there is no figure of the entire adult simulid fly!—would have increased the value of this first part of the book.

In the second part of the book the author begins with a summary of various classifications that have been proposed for the family but without presenting much critical comment upon the various segregates proposed. He accepts the simple classification proposed by EDWARDS (1931, *l.c.*) and as later modified by EDWARDS (*Arch. Hydrobiol.*, 1934, Suppl., Bd., 13, 92–138). He rejects the

classification of ENDERLEIN (*Arch. Phylog. Ent.*, 1930, v. 1, 77–97 ; and elsewhere) with its multiplicity of genera. He rejects the recent classification of RUBTZOV (*Faune de l'U.S.S.R., Insectes Diptères, Fam. Simuliidae*, 6(6): 1–532, 1940) which is in its turn derived to a considerable extent from the Enderleinian system. He does not accept the classification proposed by TWINN (*Canad. Jl. Res. Sec. D.*, 1936, v. 14, 97–150) for the North American fauna. There are useful tabular statements of the classifications of ENDERLEIN, TWINN and RUBTZOV.

In the catalogue of the sub-families, tribes, genera and sub-genera which follows, the method of presenting the material is somewhat extended and it is doubtful if the extension succeeds in conveying much more information than would some of the more compact and space-economizing methods commonly in use amongst taxonomists. Three generic names are omitted : *Miodasia* Enderlein (*Tierwelt Mittelcurop.*, 1936, v. 6, iii Teil, 2 Lief., xvi, 39) genotype, *M. opalinipennis* n. sp. (*l.c.*), *Simulidium* Westwood (*Qu. Jl. Geol. Soc.*, 1854, v. 10, 384 and 394) genotype, *S. priscum* n. sp. (*l.c.*) and *Pseudosimulium* Handlirsch (*Fossilen Insekten*, 1906, Lf. 4, 631) genotype, *S. humidum* Brodie (by designation of Handlirsch *l.c.*). The first genus was recorded in the Zoological Record of the year 1936 and its omission is regrettable ; the last two are fossil genera and it is not surprising that they have been overlooked. *Mallochella* Enderlein (1930, *l.c.*) is preoccupied by *Mallochella* Duda (*Arch. Naturgesch.*, 1925, v. 90, 74) a genus of Borboridae.

The author gives particulars of *Atractocera* Meigen, *Melusina* Meigen and *Eusimulium* Roubaud as though matters relating to these three genera were all straightforward ; they are not. The first two are still subject to a final decision amongst taxonomists as to what to do about misidentified genotypes, the second is also subject to a final settlement of the vexed question of the Meigenian names of 1800, while the fixation of the genotype of the third is a matter of interpretation of the language employed by ROUBAUD when he first used the name in a sub-generic sense, coupled with the use made of the name by DYAR and SHANNON (*Proc. U.S. Nat. Mus.*, 1927, v. 69 (no. 2636), 1–54). The genotype of *Simulium* Latreille itself is erroneously given as *reptans* Linnaeus ; the author quotes EDWARDS (*Bull. Ent. Res.*, 1915, v. 6, 23–42) as his authority for this statement. It is now generally agreed that Latreille's genotype, *columbaschensis* Fabricius, is synonymous with *columbaczense* Schönbauer and not synonymous with *reptans* Linnaeus. A review is not the place to discuss this matter ; it will be taken up in a paper by the reviewer that is in the press (*Trans. R. Ent. Soc. Lond.*).

In giving, in the final section, the catalogue of New World species the author has performed a useful service, the last catalogue of North American species being that of DYAR & SHANNON (1927, *l.c.*) and of South and Central American species that of PINTO (*7a Reun. Soc. Arg. Pat. Reg. Norte*, 1932, v. 60, 661–763) ; a considerable number of new species have been described since then by various authors. It would have been helpful if the author had indicated new synonymy, if any, and the authorities for the old. One or two points struck the attention of the reviewer as he looked through this catalogue. *S. chilense* Philippi is given as a species and then immediately below, where *S. chilianum* Rondani (or as some writers would put it *chilianum* Philippi in Rondani) is treated as a valid species, *chilense* Philippi appears as a synonym. It cannot be both ; the reviewer recently considered them distinct species (SMART, *Proc. R. Ent. Soc.*, B, 1944, v. 13, 131–136). Further on, *hirtipes* Fries of EDWARDS (1931, *l.c.*) is given as synonymous with *hirtipes* Fries of ENDERLEIN ; this is not the case and ENDERLEIN (*Zool. Anz.*, 1925, v. 62, 201–211) proposed the name *nigripes* for the species that he maintained EDWARDS had, in many places, misidentified as *hirtipes* Fries (SMART, *l.c.*).

A large number of references are given with each species. This will enable the user of the book to ascertain most of the important writings on each. In a purely systematic catalogue there would be a temptation to cut down the number of these references, and their inclusion is important for the practical man, for whom the book is apparently intended.

To summarize : the book, in the reviewer's opinion, is one for the research worker who is engaged in research on the Simuliidae, and if he is a novice to the family, the first part will provide him with a sound background knowledge of the biology of the flies provided it is realized that the author's treatment of his subject is not exhaustive. The catalogue of genera is useful, but the fact that the author has not given much detail of the pros and cons of the different classifications detracts from its usefulness to the taxonomist. The catalogue of the species is useful to workers in the New World in that it brings the catalogues of Pinto (*l.c.*) Dyar & Shannon (*l.c.*) and Edwards (1931, *l.c.*) up to date.

Lest the reviewer, in his comments on what, to many, may appear rather small points, seem over-critical, he would hasten to mention that in reading through Dr. Vargas' work he has picked up two or three points connected with the Simuliidae which had eluded his own notice during the period of years that he has had a particular interest in the family.

The book is in Spanish. *John Smart.*

Mackie, Thomas T. [M.C., A.U.S., etc.], Hunter, III, George W. [Sn. C., A.U.S.] & Worth, C. Brooke [M.C., A.U.S.]. **A Manual of Tropical Medicine. Prepared under the Auspices of the Division of Medical Sciences of the National Research Council.** pp. xix+727, 287 figs. (6 in colour). 1945. Philadelphia & London : W. B. Saunders Co. [30*s.*]

" The preparation of this manual was undertaken to provide a concise statement of the most recent available and authoritative information concerning the more important tropical diseases. It is obvious that such a presentation can in no way supplant the standard texts in this field. . . . The book . . . should serve as a convenient summary for public health workers, epidemiologists and parasitologists."

This quotation from the authors' preface is a just appraisal of the work ; to claim, as does Brigadier General Simmons in his foreword, that the book " will fulfil the demand for authoritative up-to-date information for those who must protect our soldiers against such diseases [*i.e.* tropical diseases] and for those who must prevent the introduction of these diseases into the United States " is to go too far. The authors have been engaged in teaching tropical and military medicine at the Army Medical School, Washington, and they have assessed very well the needs of the Service medical officers for whom this book is intended, but they do not claim too much for it. No book of this length could be comprehensive, but within its acknowledged limits this manual is excellent. There are no wasted words, the writing is clear, and the information is sound and remarkably up to date.

There are 11 Sections, on the viruses, the rickettsial diseases, the spirochaetal diseases, the bacterial diseases, the mycotic diseases, the protozoal diseases, the helminthic diseases, the nutritional diseases, miscellaneous conditions, medically important arthropods, and laboratory diagnostic methods, in that order, and there is a good index. In this way the reader is given a conspectus of all those sides of tropical medicine in which he may become interested, and emphasis is wisely laid on epidemiology and control.

There are, of course, omissions, but they are few. No mention is made of viscerotomy in yellow fever control, and it is not brought clearly enough to the

student that the recent outbreak of yellow fever in the Sudan indicated the danger of spread to the Far East, where conditions would be very ripe for a disastrous epidemic. The authors state (p. 31) that "it is impossible to differentiate epidemic typhus, murine typhus and Rocky Mountain spotted fever by means of the Weil-Felix reaction since high OX19 titers may occur in all these diseases." This conflicts with the usual opinion that the reaction in the tick-borne rickettsial diseases is usually of low titre. A warning is rightly given that louse-borne typhus may be contracted by the inhalation of infected dust; it might have been added that there is a danger to the medical man of acquiring the disease during the process of taking blood for the Weil-Felix test. The bald statement (p. 48) that there is no specific treatment for Rocky Mountain spotted fever leaves out of account the promising American work on hyper-immune rabbit serum. An instance of the modernity of the information is the reference (p. 58) of the value of dibutyl phthalate in the prevention of tsutsugamushi disease.

Amoebiasis has become one of the major therapeutic problems of the war, and current opinion is that success in treatment, especially in chronic cases, depends not only on the use of the right drugs, but also on the observance of essential details in their administration and in the management of the patient. The description given by the authors of the various methods of treatment will not greatly help those dealing with difficult cases.

In the description of malaria a good impression is given of the complex subject of *Anopheles* transmission, and a list of the chief vectors, with their geographical distribution and habits, occupies 6 pages. The only important species omitted is *A. melas*, but there is reason for this as it has only recently been differentiated as a species from *A. gambiae*; nevertheless it was well known for many years as the black variety of *A. gambiae*. On page 248 it is stated that malaria can break through a routine of suppressive mepacrine in doses of 0·1 gm. daily, in the presence of excessive fatigue, trauma and haemorrhage, but there is very good evidence that this dosage is rarely inadequate even under the most exacting conditions. The authors do not make the point that suppressive mepacrine can completely prevent malignant tertian malaria, but that benign tertian is likely to occur after cessation of the suppressive routine.

In the section on leishmaniasis no mention is made of local infiltration of oriental sore with mepacrine, a treatment which has received much favourable note. In the treatment of African trypanosomiasis it is stated that lumbar puncture should be performed immediately, but it would have been wise to say that the puncture should be postponed until the blood had been sterilized, so that the danger of introducing trypanosomes directly into the cerebrospinal fluid might be avoided.

For a book of this size the section on medically important arthropods is a long one, it comprises 143 pages of good material, and it includes much advice on control. Medical officers in the field will appreciate this information. Another useful feature of the book is a good section on anthelmintics.

For the rest, the binding and paper are excellent, and the illustrations superb. Interesting and well drawn diagrams illustrate the important epidemiological points. There are very few misprints. Without qualification this book can be recommended to Service medical officers; the authors are to be congratulated on the results of their care and industry. *Charles Wilcocks.*

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